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ABSTRACT

This four-volume student text is designed for use by Air Force personnel enrolled in a self-study extension course for optometry specialists. Covered in the individual volumes are optometry clinic administration (optometry career and field training, ethical relationships and professionalism, eligibility for optometric care and appointment scheduling, facilities and personnel, administrative record keeping, equipment and supplies); preliminary clinical procedures (vision screening and additional preliminary tests); spectacle-related procedures (spectacle fitting and repairing, orders, and verification); and advanced optometry clinic procedures (specialized clinical techniques, visual programs, evaluation of ocular conditions, and classification of contact lenses). Each volume in the set contains a series of lessons, exercises at the end of each lesson, a bibliography, and answers to the exercises. Supplementary volume review exercises and a change supplement are also provided. (MN)

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ED268337

OPTOMETRY SPECIALIST

(AFSC 91255)

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LIST OF CHANGES

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1. CHANGE FOR THE TEXT: VOLUME 1

Page 2, col 1, line 2: Change "awarded only" to "only awarded.: Line 3: After "of" add "the 5 level CDC, successful completion of" and delete "and." Lines 4-5: Delete "satisfactory performance in . . . least 6 months,."

2. CHANGES FOR THE TEXT: VOLUME 2

a. Page 1, col 2, last line: After "eyelids," add "and." Line 2 fr bot: Change "three" to "two."

b. Page 2, col 1, line 1: Change "eye, and (3) the fornix," to "eye. The fornix is."

c. Page 25, col 1, line 8 fr bot: Change "RE(T)"" to "RE(T)'." After line 8 fr bot; under "*Distant*" add "RHT" and "RHypoT" and under "*Near*" add "RHT" and "RHypoT'." Line 22 fr bot: Change "they are a "right hypertrope (RHT)" to "then the patient has a left hypotrope (LHypoT)." Line 24 fr bot: Change "always "hyper-" and the eye is that which turns upward" to "the eye and direction of deviation." Line 26 fr bot: Delete "partly."

3. CHANGES FOR THE TEXT: VOLUME 3

a. Page 17, col 2, line 26: Change "plus" to "minus." Lines 29-32: Delete "To convert cylinder . . . as new axis."

b. Page 44, col 1, line 2 from bottom: Change "Graps" to "Grasp."

c. Page 45, col 1, line 21: Delete "changing to plus cylinder form and." Line 26: After "OS" and "+." Lines 29 thru last: Delete and replace with
"*Step 1.* Add the add to sphere.
OD (+2.00+1.50)-1.00 X 180
OS (+2.50+1.50)-0.75 x 180

Step 2. New Rx for Near.
OD +3.50 -1.00 X 180
OS +4.00 -0.75 X 180."

d. Page 45, col 2, lines 1-3: Delete "*Step 3*. . . .165."

e. Page 53, answer 418-2: Delete and replace with
"a. OD +2.25 -0.75 x 090
OS +2.50 -0.50 X 090

b. OD -0.75 -0.75 X 075
OS -1.00 -0.50 X 115."

4. CHANGE FOR THE TEXT: VOLUME 4

Page 32, col 2, line 2: Change "docotr" to "doctor." Lines 21-22 from bottom: Delete "The patient will . . . requesting supervisor" and replace with "Complete a DD Form 1348-6, non-NSN Requisition, attach DD form 771 and send forms and patient (optional) to medical supply." Lines 14-18 from bottom: Delete "The forms. . .using organization" and replace with "The industrial thickness safety spectacles are purchased by medical supply from local optical labs. Medical supply may require patient to take Rx to the optical lab. If medical supply has a contract with an out-of-town lab, then the Rx will be mailed, of course."

LIST OF CHANGES

COURSE NUMBER 91255 EFFECTIVE DATE OF SHIPPING LIST 25 Jan 85	CAREER FIELDS, POLICIES, PROCEDURES AND EQUIPMENT CHANGE. ALSO, ERRORS OCCASIONALLY GET INTO PRINT. THE FOLLOWING ITEMS UPDATE AND CORRECT YOUR COURSE MATERIALS. PLEASE MAKE THE INDICATED CHANGES.

5. CHANGE FOR THE VOLUME REVIEW EXERCISE: VOLUME 1

Question 57 is no longer scored and need not be answered.

6. CHANGE FOR THE VOLUME REVIEW EXERCISE: VOLUME 3

Question 60 is no longer scored and need not be answered.

7. CHANGE FOR THE VOLUME REVIEW EXERCISE: VOLUME 4

Question 6 is no longer scored and need not be answered.

91255 01 8210

CDC 91255

OPTOMETRY SPECIALIST

(AFSC 91255)

Volume 1

Optometry Clinic Administration

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Air University

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EXTENSION COURSE INSTITUTE, GUNTER AIR FORCE STATION, ALABAMA

THIS PUBLICATION HAS BEEN REVIEWED AND APPROVED BY COMPETENT PERSONNEL OF THE PREPARING COMMAND IN ACCORDANCE WITH CURRENT DIRECTIVES ON DOCTRINE, POLICY, ESSENTIALITY, PROPRIETY, AND QUALITY.

Preface

IN THE PAST few years, the demand for medical and paramedical care has increased tremendously. Along with that increased demand, there has been an actual decrease in the number of personnel available to care for those who want medical treatment. Nearly any week you can read an article in the *Air Force Times* about the decrease in professional staff in our health care facilities and the constantly high demand for adequate treatment in all specialties.

One remedy for the problem of the decreasing ratio of doctors to patients is to use more well-trained technical assistants in all medical career fields, both military and civilian. As an optometry specialist, you are one of the cornerstones of this revolution in health care. This concept should be able to help both you and the patients in our medical care facilities.

This Career Development Course for the 91255 specialty covers administrative procedures of your clinic; a review of specialty fundamentals; procedures for specific tasks; and expanded information in special clinical areas of technical knowledge.

Volume 1 reviews your job description, clinic safety, tips on public relations, and setting up appointment schedules. It also covers such underrated areas as maintaining the facility and equipment, recordkeeping, and self-inspections. Volume 2 deals with the anatomy and physiology of the ocular areas and a majority of the tests used during a visual screening. Volume 3 reviews spectacle fitting, repairing, ordering, and verification under current Z.80 tolerance standards. Volume 4 expands your knowledge of the specialized clinical areas, such as visual training, tonometry, medical profiling, and referrals.

Appedixes A, B, C, and D are printed and bound in the back of this volume. Use them as you need when referenced in the text.

Foldout 1 is printed and bound in the back of the volume.

Code numbers appearing on figures are for preparing agency identification only and should be of no concern to the student.

Direct your questions or comments relating to the accuracy or currency of this volume to the course author: School of Health Care Sciences, USAF/MSTW, ATTN: TSgt Michael O. Kille, Sheppard AFB TX 76311. If you need an immediate response, call the author, AUTOVON 736–4471, between 0700 and 1600 CST, Monday through Friday. *(NOTE: Do not use the suggestion program to submit changes or corrections for this course.)*

If you have questions on course enrollment or administration, or on any of ECI's instructional aids (Your Key to a Successful Course, Behavioral Objective Exercises, Volume Review Exercise, and Course Examination), consult your education officer, training officer, or NCO, as appropriate. If this person can't answer your questions, send them to ECI, Gunter AFS AL 36118, preferably on ECI Form 17, Student Request for Assistance.

This volume is valued at 12 hours (4 points).

Material in this volume is technically accurate, adequate, and current as of September 1981.

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NOTE: In this volume, the subject matter is developed by a series of student-centered objectives. Each of these carries a three-digit number and is in boldface type. Each sets a learning goal for you. The text that follows the objectives gives you the information you need to reach that goal. The exercises following the information give you a check on your achievement. When you complete them, see whether your answers match those in the back of this volume. If your response to an exercise is incorrect, review the objective and its text.

Optometry Career Field and Training

THE FIRST CHAPTER of this CDC is intended to give you a better idea of what the optometry career field is all about, what to expect as you progress up the career ladder, and how to prepare yourself effectively for further advancement.

1-1. Accreditation, Certification, and Training

The Optometry AFSC 912X5 was authorized as a career field subdivision 1 January 1971. It is a relatively small AFSC with good opportunities for advancement and maintaining close friendships with others in the same career field. Military training in this AFSC is also applicable to several civilian jobs.

001. Cite sources of information on the accreditation of optometry specialist courses and the certification of optometric personnel.

Civilian Organizations. Many schools and colleges are offering 1- or 2-year paraoptometric technical programs. You may want to continue your education by attending some of these courses. If you decide to do so, you will be happy to know that your military training has given you transferable credits, which may be applied at several civilian institutions. It is your responsibility to check with a particular college to see if it accepts transfer of credit. (Appendix A–1 lists civilian programs, and Appendix A–2 gives general information on civilian programs.) Let's look briefly at three organizations concerned with accrediting Air Force optometry courses and certifying specialists and technicians.

The council on Optometric Education of the American Optometric Association keeps a list of approved optometry-related courses. It has investigated and approved the 3ABR91235 course at Sheppard AFB. All course material in both 3ABR91235 and CDC 91255 meet the high standards of the AOA.

The Southern Association of Colleges and Schools and the Commission on Occupational Educational Institutions have also accredited both courses through the Community College of the Air Force (CCAF). Optometric Technology is one of the degree programs available through CCAF. The 3ABR91235 course now gives 17 credit hours, and this CDC (91255) adds 4 more hours toward the 64-hour program offered by CCAF. See your education office for more information.

Many optometry specialists feel they need more recognition. The AOA Paraoptometric Section developed two examinations. Upon passing one or the other exam, the optometry specialist is enrolled in the *National Paraoptometric Registry* and granted the title of Registered Optometric Assistant or Registered Optometric Technician. Request more information from: AOA Paraoptometric Section, 243 N. Lindbergh Blvd., St. Louis MO 63141.

Exercises (001):

1. Name two organizations that have approved or accredited the 3ABR91235 or CDC 91255 courses.

2. Whom should you contact to get more information on college credit for your training?

3. What organization lists registered optometric personnel?

002. Cite requirements for advancement in the optometry field.

The Military Optometry Career Field. Advancement in the 912X5 career field is based upon your successful completion of appropriate tests in the field. The Optometry Specialist Airman Career Field Chart (fig. 1-1) is adapted from AFR 39–1, *Airman Classification Regulation*, the master guide for job classifications. The airman

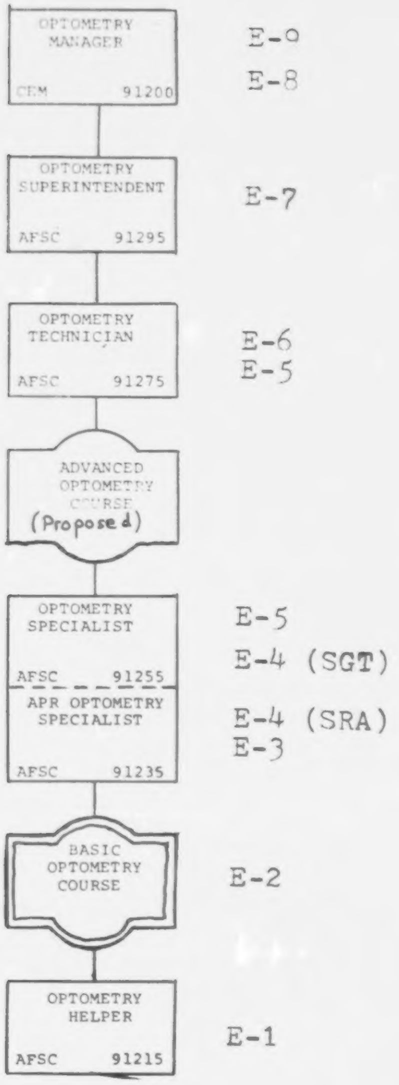


Figure 1-1. Optometry Specialist Career Field Chart.

classification structure is designed to afford airmen jobs of increasing responsibility. The 5 skill level is awarded only upon successful completion of a training program, and satisfactory performance in a 5-skill-level job for at least 6 months, and recommendation by your supervisor. There is as yet no advanced course for the 91275 AFSC, and award of the 7 level is based upon successful performance of duties to a level shown in your specialty training standard (STS).

AFR 39–1, Volume 2 (C–9), dated 30 April 1981, gives the specialty description for the 912X5 career field. The 3- and 5-skill-level descriptions are exactly the same; the two levels depend on your knowledge and performance of the tasks listed in your specialty training standard (STS). In addition to the basic duties of the 3 and 5 levels, the 91275 "performs routine and/or technical visual screening tests; and supervises optometry activities." The difference in wording here means that the specialist assists or does these tasks with more supervision from a supervisor or the base optometrist. The technicians can do most of the work by themselves or with less stringent supervision. In fact, they will actually supervise lower level airmen in their tasks.

There are slight differences in the section on duties and responsibilities. For example, both levels make vision screening tests, but the 7 level prepares reports on the findings. There are other statements about the 7 level's increased supervisory duties. Remember, though, that the basic duties of the three levels are the same. To move up on the career ladder, you must show the ability to do your duties more efficiently and more competently.

Related Civilian Career Fields. There are several civilian jobs related to your speciality. The first and most closely related job is that of an optometric assistant to a civilian practitioner. In addition to the knowledge and skills that you have gained in the Air Force, you will need to know more about bookkeeping, typing, and frame fashions. Many schools offer courses that would prepare you to work as a civilian optometric assistant. (See Appendix A.) Another civilian job related to yours is that of dispensing optician. In addition to the subjects we just mentioned, you may have to learn lens surfacing and edging. You must learn surfacing and edging to work as a laboratory optician. You may get more information about opticianry from the American Optical Co., Bausch & Lomb Optical Co., or from your local dispensing or laboratory optician. Finally, if your are really interested in making a career in the eye care field, you may decide to become either an optometrist or ophthalmologist. Request information on these professions from the American Optometric metric Association, from the American Medical Association, or from your local practitioner.

Exercises (002):

1. List three requirements for award of AFSC 91255.

2. What general condition must you meet for advancement to the 7 level?

3. What are the basic differences among the 3, 5, and 7 skill levels?

4. What civilian job related to the optometry specialist requires the least additional training for entry?

003. Name the two channels of OJT, and cite basic controls on OJT.

The Dual-Channel OJT Concept. "On-the-job training" is an all-inclusive term for any training received by an airman performing in a duty assignment of his or her Air Force specialty. Since "upgrade training" (training for the purpose of upgrading your AFSC in skill level) is the most common type of OJT, it is no surprise that upgrade training is often informally referred to as OJT. Other types of OJT include lateral training, retraining, and qualification training. Since upgrade training is the primary purpose of 5-level CDCs, the other types of OJT will not be discussed.

The two parts of the dual-channel OJT program are knowledge and job proficiency development. These elements are also called *career knowledge training* and job proficiency training. Career knowledge training is administered under one of two methods, depending on the availability of CDCs. Use of the CDC is mandatory when one is available in the AFS at the skill level toward which upgrade training is directed. Specialty training standard (STS) study references were used before this CDC became available. An STS in the 912X5 specialty is included in each optometry specialist's OJT folder. STS study references normally refer the trainee to standard Air Force publications, such as regulations and manuals.

Career knowledge development includes acquiring information on career field fundamentals, learning basic principles and fulfilling the common knowledge requirements applicable to the AFS, plus learning the specific information (smaller units of knowledge) necessary to perform the duties of the particular AFSC. CDCs provide most of this knowledge, but they don't give the detailed step-by-step procedures for specific tasks. This is included in manuals and is taught on the job by your OJT trainer or supervisor. In brief, the first step you take to qualify for a higher skill level and higher rank in the Air Force is to study the applicable CDC.

Job proficiency training, is basically gaining skill while you do the duties and tasks of an AFSC; secondly, it is applying the knowledge you got from studying the CDC. Your supervisor must certify that you have the needed job proficiency before you can be upgraded.

Use of JPG. During OJT, your supervisor must develop and use your JPG to improve your job proficiency. It gives you a specific reference to an authoritative publication for each task done in a current duty assignment. Your JPG is developed by annotating a copy of the STS to identify the tasks you do in your current job. Since the STS may not list every task you do, it must be supplemented by your supervisor to include the either tasks. This annotated and supplemented STS, identifying each task element of your current job, becomes your JPG.

Practical application of OJT. You are placed in an operational situation, requiring you to do certain specific tasks. As you gain skill in the simplier tasks of your specialty, you are given others that are more and more difficult. Thus, you constantly broaden your knowledge and skill until you master all the elements of your job. In the meantime, the Air Force benefits from your work while you are learning.

Learning in an OJT situation comes from the close association of a trainee with a skilled technician who serves as the trainer. Note, however, that this coach-pupil method does not prevent short periods of group instruction. Such group instruction is sometimes the most practical way for discussing material presented in the CDC—providing further explanations of such things as theory, background material, and safety precautions—information that all trainees must know.

Your CDC may not include some of the more recent changes in Air Force publications that affect your duties. This means that you cannot use this CDC as the "last authority" in doing your daily job. Although optometry personnel are constantly revising and updating your CDC, it may take them 9 months or longer to get a change included in your CDC. Also, it may take 9 months or longer to get changes included in your specialty knowledge test (SKT), one of the tests you take for promotions to sergeant through master sergeant. However, your knowledge of an old procedure will help you understand the new procedure. Use the most current Air Force publication as the "last authority" in doing your daily tasks, but study your CDC for OJT.

Role of Air Force publications. Your CDC and SKT are based on Air Force publications. Sometimes major commands, numbered air forces, wings, or medical facilities implement and augment Air Force publications. They get authority from higher headquarters to implement or augment actions appropriate for their own operational situation. Then they publish supplements to the basic Air Force publication. As a part of your job proficiency training, you need to know about those supplements that affect the duties of an optometry specialist. However, use the Air Force publication itself in studying your CDC and in answering questions on your SKT.

Exercises (003):

1. What are the two elements into which dual-channel OJT is divided?

2. How was upgrade training done before the development of the CDC?

3. What is a job proficiency guide (JPG) and who develops it?

4. When a procedure in a new Air Force publication differs from the one in your CDC, which authority should you use?

1-2. The Optometry Clinic

Hospital and optometry clinic organizational charts have undergone several revisions in the past few years. At one time the "eye clinic" was staffed entirely by enlisted personnel and was usually affiliated with the flight surgeon's office. Until relatively recently, the optometry clinic could have been under the authority of either the flight surgeon, ophthalmology department, department of professional services, Air Force clinics, EENT clinic, or under the general heading of "outpatient care clinic."

004. State how the optometry clinic fits into the overall organizational and functional structure of the Air Force.

Clinic Organization and Function. At the present time, AFR 168–4, *Administration of Medical Activities*, states that the optometry clinic should be a subelement of the Primary Care Service, unless there is an ophthalmology clinic; then it is part of the ophthalmological service. As you remember from your days in basic training, the main mission of the Air Force is to deter war. How do you as an optometry specialist fit into the big picture? Can you image yourself dropping old broken frames from a high-flying B–52 to distract the enemy's radar?

The function of a USAF Medical Facility is to support the mission of the AF by providing the best medical care possible to our active duty personnel, their dependents, authorized retired personnel, and their dependents. The general idea is that the USAF member cannot perform efficiently if either he or she or a member of his or her family is sick. With the great emphasis on vision-related performance that has arisen during the past few years, the role of the optometry clinic has increased. Pilots cannot fly if they cannot see properly. Children cannot learn efficiently if the chalkboard is blurry. Our function, then, is to maintain the visual health and efficiency of military members and their families who are authorized to use our medical facilities.

Clinic Capabilities. Clinic capabilities are dependent upon the resources available in the medical facility. A general statement is that the optometry clinic is responsible for the prevention, detection, and treatment or referral of eye problems.

Preventive measures are taken by means of the eye safety program. Detection of visual anomalies, while still in their early stages, is accomplished by vision surveys conducted in local schools or offered in the clinic as part of the eye examination. Treatment of vision problems may be with appropriate ophthalmic devices, orthoptics (vision training), or by referral to another clinic for medical, surgical, or psychiatric treatment. Ideally, a large USAF installation should have these optometry services:

(1) School screenings.
(2) Driver's license exams.
(3) Occupational vision testing.
(4) Contact lens services.
(5) Vision training procedures.
(6) Pathology detection/referral services.
(7) Muscular coordination tests.
(8) Dyslexia detection/referral.
(9) Visual analyses.
(10) Vision surveys (screenings).
(11) Visual field testing.
(12) Glaucoma detection.
(13) Frame fitting, dispensing, and adjustment.
(14) Spectacle repairs.
(15) Low-vision aids.
(16) Prescription verification/duplication.
(17) Learning problem school assistance.

At the present time, patient workload and staffing problems don't let us reach this ideal, but with the proper use of the 912X5 and other health care assistance personnel, we can approach it.

Exercises (004):

1. The optometry clinic is under what hospital unit?

2. How does the optometry clinic contribute to the defense of our country?

3. What is the clinic's primary function?

4. Which of the services listed in this section are offered by your clinic?

1-3. Clinic Safety

How many times have you stabbed yourself with an optical screwdriver or burned your thumb on a hot lens? These are two of the many "accidents" that may occur in the optometry clinic. Let's take a look at ways to prevent accidents in the clinic, and what to do if one occurs.

005. Cite causes of accidents, ways to avoid them in the clinic, and first aid procedures in case they do happen.

Causes of Accidents. You have heard many times that accidents don't just happen—they are caused. Only about 2 percent of all accidents are classified as due to "natural phenomena." Preventable accidents may usually be traced to unsafe personal attitudes that let a person commit an unsafe act or tolerate an unsafe condition. Read AFP 50–34, *Military Training Standard Promotion Fitness Exam Study Pamphlet*, Chapter 9, Safety, to learn more about general safety practices, their application in and out of your duty environment, and their application to the PFE. If there is an accident in your clinic, you may have to submit an accident report in accordance with AFR 127–4, *Investigating and Reporting U.S. Air Force Mishaps*, and

AFR 127–2, *The USAF Mishap Prevention Program.* Basically, these publications state that if the accident results in a disabling injury, you should report the incident on one of the Air Force Form 711 series, USAF Mishap Report. Let's look now at some optometry clinic conditions that could contribute to an accident, with resultant loss of man-hours, material, or money.

Floors. What shape is your floor in? Is it nice and flat or is it an obstacle course of extension cords, frayed rugs, and uneven tiles?

Electrical cables. How many multiple plugs do you have plugged into a single socket? Is the wattage rating of that outlet sufficient for the load? Have you strung extension cords behind radiators or wrapped them around water pipes? What conditon are your extension cords in? Is the insulation sound or are you designing a cockroach crematorium? Do you unplug all electrical cords at the end of the day?

Frame heater. Be careful that you do not keep the frame heater in an area that would tempt children. This is the most common source of minor injuries.

Chemicals. Most clinics keep a supply of acetone and alcohol on hand, but it should be stored in a metal cabinet. These highly flamable chemicals are not only an extreme fire hazard, but a broken bottle can cause damage to the floor, your uniform, or nearby supplies, but worse yet, your patient.

Examining chairs. The little rotating stools are handy to sit on, but don't use one as a ladder. Don't forget to return the hydraulic examination chair to floor level before letting the patient get up. Most patients are not issued parachutes as standard equipment. Also, don't forget to warn the patient when you are adjusting the chair.

Sometimes the easiest way to do things is not the safest way. Are you sacrificing safety for speed?

Use of improper tools. Many optometry specialists use their fingers instead of the proper tool for adjusting a frame. This practice can lead to both burned fingers and broken frames.

Overconfidence. Some specialists take pride in adjusting cold frames. If you are too bold with an old cold frame, you may have to replace the whole thing. Also—take it easy when inserting a lens into the lensometer. If you let the lensholder slip on a −8.00 D lens, you may have a quick demonstration on the breakability of glass.

Improper sterilization techniques. There are several ways to sterilize a tonometer. There are just as many ways to injure your patient. If you use a heat sterilizer, make sure that the tonometer is cool before putting it on the patient's cornea. If you use a cold sterilization technique, make sure that the tonometer is *sterile* and *dry* before use.

Improper frame fitting. Not only will a patient not wear an uncomfortable frame, but may complain loudly if the frame you use is hot out of the sandbox. Remember that temples are used to hold the frame on the patient's head, not to insert in their eyes.

Contact lens insertion techniques. Improper procedures in teaching a patient how to insert and remove contact lenses can lead to severe corneal abrasions and a possible lawsuit. This item will be covered in more detail in Volume 4.

Improper patient control. Last, but certainly not least, keep your patients and visitors under control. Some children can give Dennis, the Menace, lessons on how to disrupt a clinic. Don't let little Johnny play with the equipment while waiting for treatment.

These are just a few of the possible sources of accidental injury or damage in the optometry clinic. Your particular clinic may require special safety considerations. Keep your eyes open and report any problems to your supervisor.

First Aid for Cuts, Burns, and Shock. Sometimes an accident will happen in your clinic—either to yourself or to one of your patients. You should know what to do when an accident occurs. Read AFP 50–34, Chapter 11, "First Aid," for proper first aid procedures.

Cuts. There are several types of cuts or wounds that may occur in the clinic. For instance, you may puncture the skin with a screwdriver, or you may cut yourself on a broken lens. Usually the bleeding is not severe and may be treated by cleaning the wound and applying a sterile dressing. If there is a possibility that the wound was contaminated, a tetanus booster may be in order. If the cut is more severe, stop the bleeding first (usually by direct pressure over the wound), then prevent further contamination (with a dressing), and then get further care in the emergency room.

Burns. Burns in the optometry clinic may be caused by contact with a hot frame warmer, the most frequent cause of minor injuries, or by contact with something heated in it, or, less frequently, by exposure to a fire caused by ignition of chemicals kept in the clinic. Another frequent cause of burns is contact with a hot projector lamp while changing bulbs. First aid for burns includes procedures to: *relieve pain, prevent contamination*, and *treat shock.* Most burns in the optometry clinic will be relatively minor, and pain can be relieved by excluding air from the injured area. A thick dressing for this purpose will also prevent contamination. If the burn is severe, go to the emergency room.

Shock. Patients suffering from shock are rarely seen in the optometry clinic. But it is possible that an electrical accident or drug reaction may cause shock. If the shock was electrical in nature, be sure to remove the victim from the source of electricity as soon as possible. For any case of shock, keep the victim lying down and comfortable, insure proper breathing, insure the absence of hemorrhaging, and call a physician.

Exercises (005):

1. To what may preventable accidents usually be traced?

2. What Air Force publications deal with accident report?

3. What form series cover accident reporting?

4. For what problems should you inspect the electrical system in your clinic?

5. List several *potentially* unsafe practices or conditions in your clinic, giving remedies for them.

6. What are the primary considerations for treatment of cuts?

7. What are the primary considerations for treatment of burns?

8. What is the first thing to do in treating the victim of electrical shock?

Ethical Relationships and Professionalism

IT IS EXTREMELY important for patients to have confidence in the medical personnel who treat them. Confidence can be instilled in the patient only by the proper combination of ability, concern, and ethics on the part of the specialist. The purpose of this chapter is to show you some of the "good things" to do in order to increase patient confidence.

2-1. Clinic Ethics and Personal Relations

Once in a while the whole workweek seems to be made of Mondays. Sometimes it seems as if the NCOIC of Mondays had cleaned out his or her excess stock and unloaded a few tons of essence of Monday morning on your Wednesday afternoon. Here you are halfway to work, and you suddenly realize that you forgot your hat in the chow hall. Somebody goofed in Linen Control and your whites look more like wrinkled yellows. Ground Safety just called and requested 50 "emergency screenings" for the occupational vision program, and the lab just dumped 100 pairs of glasses on you for verification. Your Red Cross volunteer called in sick, and Mrs. Smith and her six ankle biters are scheduled for eye exams and you *know* they'll be a half hour late. How can you do your job properly with condensed Monday morning spilling all over your desk?

006. Cite the basic guides for disclosing information about patients.

Maintaining good working relationships with your coworkers and patients takes more than just the "three qualities" discussed here. Working in close proximity to any person or group often leads to feelings of frustration if things don't go just right. The three qualities—confidentiality, service, and capability—can be considered the *minimum* necessary needed to do your job adequately and with few personality conflicts.

Confidentiality. As an optometry specialist, you have access to information about your patients that may be confidential in nature. You may learn that Mrs. Smith is undergoing treatment in the psych clinic. You may even see a lab report on one of her kids showing leukemia. During the course of your examination, you might find indications of glaucoma. Well, what do you do about it? Do you take these juicy tidbits of information to the club and blab about them to your buddies? The answer to that is a most definite NO. There is never any justification for reporting information outside of the need-to-know group.

But who does have the right to know about your patient? Obviously, if you learn something about the visual health of your patient, your doctor should know. Or, if you learn something that may influence the treatment of the patient by a physician, the physician should know. If the information concerns a likely detriment to the patient's ability to work, the patient's supervisor should know.

A communication between a patient and doctor is not always a privileged communication. When it is privileged, the doctor has the right and duty to keep silent about the things learned from the patient. The doctor doesn't even have to tell about it in a court of law (but may testify about it if the patient asks). When the communication is not privileged, a doctor can be legally ordered by a court to testify about information learned from a patient. Some states have laws that make certain communications between a patient and doctor privileged.

In the Armed Forces, a communication between a patient and an Armed Forces doctor is not privileged under the *Manual for Courts-Martial*. A doctor can be ordered to testify about information learned from a patient. Then, the results of the evaluation can be used to discharge the person from the Air Force. Technically, any information that an Armed Forces doctor learns from a patient can be used by the Armed Forces either in a court-martial or in other administrative action against the patient.

But beware! Even though information learned by an Air Force doctor from an Air Force patient is unprivileged,*it is not public information*. A patient may sue a doctor who uses medical information in an unprofessional way. The same applies to you as an optometry specialist. You hear a lot of medical information in your medical facility, and you read a lot of medical information in individual medical records. Use it in your official job. Don't tell other people about it unless they need the information to help treat the patient or to prepare medical records.

You frequently hear that medical information is confidential. It *is* confidential, but it is not *classified* security information. Again, remember that information that affects the national security is classified as Confidential, Secret, or Top Secret. Both civilian and military medical people refer to medical information as "confidential information." In this context, it means that they can reveal the information only to certain people without the patient's specific consent.

Service. The hospital is a service organization. That means we provide service to those who need it. Sometimes there is a difference of opinion on just who needs it, and this will be covered in Chapter 3. Meanwhile, keep in mind that we provide service to the patient, not the other way around. Another way of stating it may be: "The patient is always right until proven wrong." Some of the services you can perform for your patients are quite evident from your job description. Other services—those little "extra goodies"—may not be quite so evident, yet definitely contribute to a smoother operation in the optometry clinic. Let's take a look at some of these extra goodies.

Medical records. Surprisingly enough, not all optometry clinics pull the records of a patient before an appointment. The patient then has to walk down to the records section and wait until the records are pulled. Sometimes this takes too much time away from the examination. Have the medical records ready and the exam sheet filled in as much as possible before the patient arrives. This will save time in the long run.

Delayed care. Sometimes the clinic is so busy that you can't get to a patient immediately. Don't ignore your patient. Tell your patient the reason for the delay, but use discretion. Don't tell the patient that the doctor is "out paying the phone bill" or is "making a BX run." A safe statement might be, "The doctor is busy and will see you as soon as possible."

Lab or clinic errors. Verify prescriptions before dispensing them to the patient. Nothing is more embarrassing than to tell the patient that he or she will get used to the glasses and then find out a week later that the Rx was wrong. Also, keep tabs on your late orders. If an Rx is late in coming back and no delay slip was received, a phone call to the lab might help.

Emergency exams. It has often been said that there is no such thing as an optometric emergency, but there are certainly times when some things are more imperative than others. If patients, through no fault of their own, need an "emergency" exam, consider squeezing them in. Quick help may also be had from a supply of spherical lenses intended to replace broken high-power lenses. This emergency procedure can keep a high myope or hyperope on the job when otherwise he or she might have to wait a couple of weeks for new glasses. Spherical equivalents will be covered in greater detail in Volume 3, Chapter 3.

Capability. Basically, this means to know your job and how to do it. If you don't know what you are doing, even the best snow job in the world won't fool the patient for long. If there are some areas in which you are unsure of your proficiency, ask your boss for help. He or she will be glad to help you in the interest of better clinic efficiency.

Exercises (006):

1. When may a doctor reveal to a civilian court of law details of a patient's privileged communication?

2. Why may an Air Force doctor have to testify on an airman's confidential medical history in a military court?

3. Why is sensitive medical information "confidential," but not classified information?

007. List desirable personal characteristics for the clinic.

Elements of Professional Conduct. From the day of your enlistment you have been encouraged to "act as a professional," or to "be a professional," or do things in a professional manner. You have likely seen items advertising "professional football" and "professional auto tuneups." Just what *is* a professional? Well, the dictionary tells us that a professional is one who works in a specific job for pay or as a means of making a living. This is differentiated from the amateur who engages in a particular job for the fun of it.

You have been in the career field long enough to realize that there isn't much "fun" in the job, and since you are working as an optometry specialist for pay, you can easily be *called* a professional, but are you *really* a professional? Let's take a look at a few of the things that differentiate the professional optometry specialist from the person who is just putting in time.

Any listing of principles under this heading would probably read as a combination of the Ten Commandments and the Boy Scout oath, so let's forget about a list to memorize and concentrate, instead, on a few high points that you really should practice and not just pay lipservice to.

Most patients who come into the clinic are a little afraid. They might be worried about eye pathology, the diminishing of their vision, or even the cost of glasses for their kids. Sometimes these patients don't look afraid or even worried, in fact, they may come on so strong that you will be tempted to show them the nearest exit. It is no fun trying to deal with a patient who seems to be harassing you, but remember that a professional isn't on the job for fun. If you habitually do your work with a high standard of efficiency and proper conduct, there should be no way that the overdemanding patient can put you down. At the same time, you should be able to relax nervous patients and put their fears at ease.

Courtesy. How can you achieve this level of patient control? Well, start off you day by being nice to your patients. Courtesy is contagious. Yes, you might have serious problems at home which will influence your attitude in the clinic, but for all you know the patient has even greater problems. It doesn't take much effort to smile and ask, "May I help you," when a patient calls or comes into the clinic. Remember—your job is providing service to the patients in your clinic, not the other way around.

Attention. What would you think if you had to go to Finance for a pay inquiry, and the people behind the counter had their feet up on the desk and were reading back issues of Popular Pornography—and didn't notice you for 15 minutes—and when you finally explained your problem, one answered by saying, "Gee, that's tough. I hope you can find somebody to help you. I can't do a thing about it"?

Well, similar treatment has been given patients in the optometry clinic, and who can blame them for acting defensive (or aggressive) in such a situation? The best way to act toward a patient is the way *you* would expect in an equivalent situation. Sounds complicated? Just remember to treat others as you would have them treat you.

Other Considerations. A few specific points might be worth mentioning in addition to attentive and courteous treatment of patients. Be confident. You have received and are receiving some excellent technical training. Don't be afraid to use your knowledge

Keep busy. There are plenty of things that need to be done around the clinic, even if it's just emptying ashtrays. If you have had a busy day and need a break, don't neglect waiting patients, and don't make it obvious that you are sneaking a little goof-off time. Don't congregate around the reception desk and discuss nonclinic matters with other personnel or criticize others. The waiting patients may have nothing better to do than to observe your antics and then mention to the commander that your shop really doesn't look busy at all.

You may decide to use your optometry skills in off-duty employment. As a general rule, the Air Force has no objection to this, but, certain guidelines for "ethical conduct" are explained in AFR 30–30, *Standards of Conduct*, and in AFR 211–16, *Personal Commercial Affairs*. Really, they are quite logical and simple. Your off-duty job cannot interfere with your AF duties and you cannot do anything on duty that furthers your private business interests. When you are on duty, you cannot solicit customers, advertise, gather names, or drop subtle hints that you have private goods or services to offer. Contact your base legal office before you accept an off-duty position that requires your optometry skills. Finally, when you leave the clinic, don't forget to take your "manner" with you. Whatever tendencies you show after duty usually spread to onduty time. You represent the clinic off duty as well as on duty, so maintain a professional and ethical attitude at all times.

Interpersonal Relations. Everyone, except a hermit, needs good interpersonal relations. People whose work brings them into close contact with the public also need to know and practice good public relations. Perhaps nowhere in the Air Force is the need for good public relations more evident than in your career specialty. Not only do you meet the public, but you do it when they are at a disadvantage. Since they are usually patients, their cordiality may be a little under par. Thus, the responsibility for assuring a cordial and concerned atmosphere is yours.

Patient-Centered Behavior. Your behavior as an optometry specialist makes your reputation, and it affects the attitudes of those people who use your medical facility. Thus your medical facility's reputation depends on your reputation as well as the reputation of every other member of your medical facility's staff. If your behavior earns you a good reputation as an optometry specialist, you should have a favorable influence on the public's attitude. Remember that both patients and your fellow workers have needs that must be satisfied. Act to satisfy patients' needs first, and let the patients know by your actions that your medical facility exists for them. Remember that patients may feel that their survival needs are threatened, so they may behave in a discourteous and demanding manner. Keep cool. Be courteous and helpful. By satisfying your patients' needs, you and the other members of your medical facility's staff will gain a fine reputation and can thereby effectively satisfy your own needs.

You are often the first and last contact that the patient has with your medical facility. First and last impressions are lasting, so know your job. When patients feel that you know your job, they tend to have a good opinion of your service to them. When you can't deliver a service to a patient, explain why. People accept an action (or a delay) better when they believe that there is a good reason for it.

Exercises (007):

1. List several desirable characteristics and state how each applies to the clinic.

2. On what does the reputation of your medical facility depend?

3. Whose needs must be satisfied first?

008. Specify the proper telephone techniques for typical clinic situations.

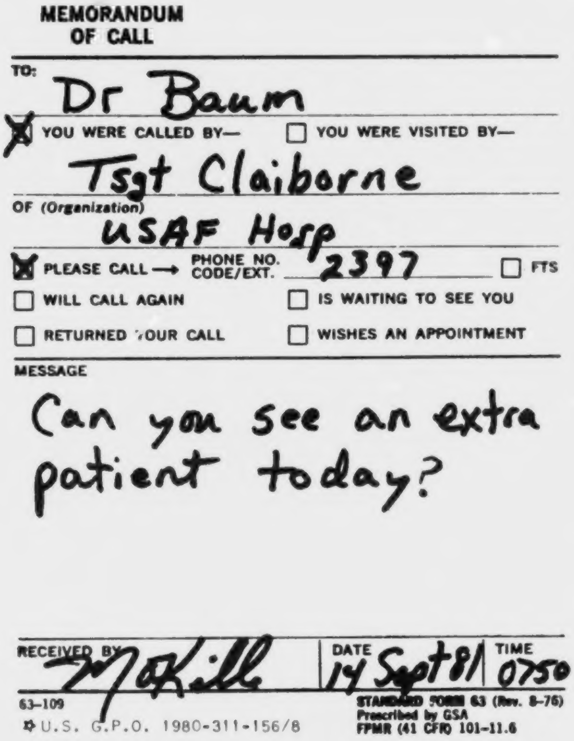
Telephone Technique. Patients are influenced not only by personal contact with optometry clinic personnel, but also by the presence or lack of good telephone technique. Here are a few rules that should help your telephone manners.

Answer promptly. Don't ignore the ringing telephone. Many patients will not break the connection until they are answered. If you are too busy to carry on a conversation, answer the phone by saying, "Optometry Clinic, please hold a few minutes." Don't make the caller hang on too long, though. Listening to a silent, forgotten line makes people angry rapidly. If you are too busy to take care of the caller in a minute or so, return to the phone and tell the patient to hold on, that you will return in a specified amount of time. When you finally take the call, thank the patient for waiting.

Identify yourself and your office. Have the courtesy to let the caller know who answered the phone. Give the name of your office, then your name, and offer assistance. It never hurts much to add "Sir" or "Ma'am" if you know the caller's gender.

Speak distinctly. How many times have you called somebody and heard just a mumble for the answerer's identification? When you speak on the phone, speak distinctly. It will save time and trouble for you and the caller.

Be prepared to take a message. If the called person is unavailable to answer the phone, take the message on a Standard Form 63, Memorandum of Call, then make sure that the message is delivered. If the call is for an optometrist or technician who is busy with a patient, don't interrupt the patient's treatment, but deliver the message at the earliest opportunity. It is usually better to have the person in the clinic return the call rather than have the patient call again, since the patient may call at another time when the clinician is busy. Figure 2-1 shows a properly completed SF 63. Here are a few quick tips: The doctor is never "busy"; he or she is usually "with a patient." This avoids the implication that the doctor is too busy to speak to any patients. Don't give unnecessary information such as, "The doctor is in another office, but will be back in a few minutes." Don't discuss classified information on the telephone. Remember that the telephone is not secure, and if you happen to have some classified information, you should not discuss it on the telephone.



MEMORANDUM OF CALL

TO: Dr Baum	
☒ YOU WERE CALLED BY—	☐ YOU WERE VISITED BY—
Tsgt Claiborne	
OF (Organization) USAF Hosp	
☒ PLEASE CALL → PHONE NO. CODE/EXT. 2397	☐ FTS
☐ WILL CALL AGAIN	☐ IS WAITING TO SEE YOU
☐ RETURNED YOUR CALL	☐ WISHES AN APPOINTMENT

MESSAGE

Can you see an extra patient today?

RECEIVED BY	DATE	TIME
McKill	14 Sept 81	0750

63-109
✩U.S. G.P.O. 1980-311-156/8

STANDARD FORM 63 (Rev. 8-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.6

Figure 2-1. Proper way to take message.

Avoid giving medical advice. Diagnosis over the telephone usually leads to erroneous conclusions. Refer the patient to the proper clinic for treatment. If you are answering questions on eye-related problems, make sure that your information is correct. It is always better to see the patient and medical records before making a decision or giving advice.

Be attentive. Listen to what the caller has to say. Don't try to listen to the phone and do something else at the same time. Both the calling patient and the other job will be downgraded. Take notes if necessary.

Don't yell into the mouthpiece. If the called party is a little distance from the phone, put the phone down gently (or put it on "hold") and approach the called party, telling them of the call. Don't put your hand over the mouthpiece and yell down the hall.

Calls for the doctor. If the doctor is with a patient and receives a call and the caller cannot wait, write the caller's name and a short message on an SF 63 and hand it to the doctor. Do not interrupt the examination by sticking your head in the door and announcing the fact of the call. Not very surprisingly, patients think that appointment time reserved for them should be used for them. Also, interruptions of the examination procedure may cause your optometrist to neglect an important procedure.

Exercises (008):

1. You are making a visual field test on a rapidly tiring patient. The phone starts to ring and there is no one else around to answer it. What should you do?

2. Your optometrist is running behind schedule and is with a particularly difficult patient. The phone rings and the caller insists upon talking to the doctor. What do you do now?

Establishing Eligibility for Optometric Care and Scheduling of Appointments

THE PURPOSE of this chapter is to describe some ways to treat a large number of patients effectively with a minimal loss of patient satisfaction. AOA studies indicate that a civilian optometrist practicing in an area with a population of 10,000 people will have a busy practice. This figure is based on the fact that the national average for optometric appointments is about one visit every three years. Military optometrists are not assigned on the basis of base population, and if they were, areas with a large number of retired personnel would be shortchanged on optometric care. In any case, military dependents average about one optometric visit every 1 1/2 years, thus doubling the military clinic's workload as compared with its civilian counterpart.

3-1. Determining Eligibility and Priority for Care

An active duty military officer or enlisted person with an Armed Forces ID Card may arrive at your clinic. This identification is normally enough evidence to establish eligibility for medical care. However, there are many categories of persons who are authorized optometry care, and the eligibility of each patient must be determined. This is one of the tasks that usually fall to the optometry specialist.

009. Given hypothetical situations, determine the eligibility for care and the administrative priority of potential optometry patients.

Governing Directives. AFR 168–6, *Persons Authorized Medical Care*, is the reference publication for final determination of eligibility for optometric care in a USAF medical treatment facility. AFR 168–9, *Uniformed Services Health Benefits Program*, outlines the services (types of care) authorized for retired members of the uniformed services and eligible dependents of active duty and retired military personnel. Foldout 1 in the back of this volume gives some general guidelines for checking patient eligibility.

There is a priority of care. AFR 168–9 states that spouses and children of retired personnel who are not eligible for hospital insurance benefits under the Social Security Health Insurance Program for the Aged are eligible for both CHAMPUS and health benefits in uniformed services medical facilities. If the clinic doesn't have enough space, facilities, or staff to provide nonemergency care to all eligible nonmilitary personnel, care goes first to dependents of active duty members and dependents of members who died serving on active duty, then to retired members and their dependents and the dependents of members who died in retired status.

Care of Nonmilitary Government Service Personnel Overseas. Several patient classes are authorized spectacles under certain circumstances while serving overseas (see FO 1). AFR 168–6 neglects to differentiate between patients who are authorized refractions before spectacles are dispensed to them and patients whose spectacles are to be ordered from old prescriptions. See local supplements to the basic regulations if you are serving in an area which has these additional authorizations. U.S. citizen employees of DOD, serving in USAFE, are authorized visual analysis on a space- available basis for a small fee.

When spectacles or special services are authorized for personnel other than military active duty members, dependents, and retired members, there may be a charge for the services and materials provided by the clinic. Prior to rendering the service to the patient, refer the patient to the resources management office for payment. The patient should return to you with a payment voucher. Record the voucher number or whatever form you are using to record the service rendered.

Exercises (009):

1. Assume that you are working at a relatively small airbase somewhere in the United States. Which of these patient classes are authorized optometric eye care at your facility?

   a. Navy seaman on leave.

   b. Active National Guardsman (rifleman).

   c. Disabled veteran.

   d. Red Cross field representative.

   e. German pilot on leave from Sheppard AFB.

   f. Dependent daughter of Army SFC.

   g. Lockheed technical representative.

   h. Dependent mother-in-law of retired AF MSgt.

2. In this same situation, which optometric services (examination or dispensing) are authorized these people, and what fees are involved?

3. If this clinic were located in Europe, which of these same people would be authorized treatment?

4. What services are these people authorized in Europe, and what fees are involved?

5. Group the authorized individuals in order of administrative priority (assume an overseas assignment)

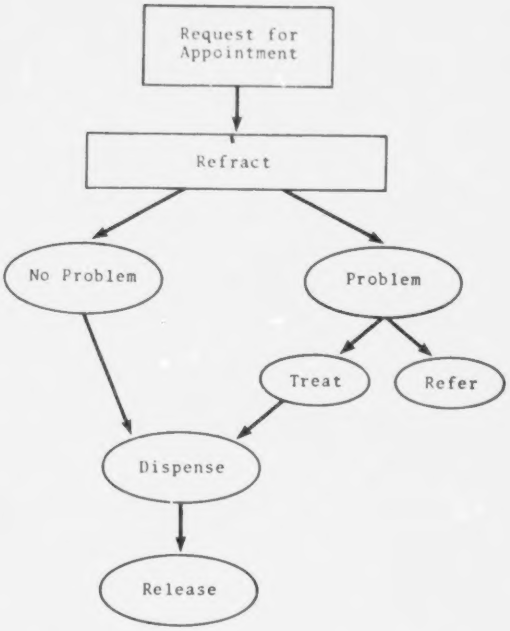


Figure 3–1. Walk-in system flow chart.

0.0. For typical clinic situations, specify the systems to use for establishing priority for "refractions" based on patient need.

We said that the Air Force divides optometry patients into four categories: active duty, dependents of active duty, retired, and dependents of retired. How can you reconcile this administrative priority system with the people's needs for appointments? There are several systems in use in the AF today. Let's take a look at some of them and compare their advantages and disadvantages.

Walk-In System (No Priority). This system (fig. 3-1) isn't used much for visual analysis appointments but is still used somewhat for screening appointments. The patient who walks (or calls) in is automatically given the next available appointment. For "refraction" appointments, the advantage is that the patient gets the earliest appointment with the optometrist. The disadvantages include an extremely long waiting list (unless closeout date is established and much professional time is wasted on patients who don't need to change Rx. The waiting list for military is the same length as that for dependent. Patient's who need faster care often see a civilian practitioner. There is a possibility of leaving pathology undetected for an inordinate time. Patients with acute problems have the same waiting time as patients with little or no need.

Military Priority System. Many clinics give priority to active duty military patients by reserving the first few appointments each day for military only (see fig. 3-2). This usually makes the military waiting list shorter than the dependent waiting list, but if this is the only priority system, it keeps most of the disadvantages of the walk-in system.

Preliminary Triage System. Recognizing the need for some control of patient appointments, many clinics initially triage patients by simply asking them to describe their problem. Patients with acute difficultes, such as broken glasses or sudden changes in vision, are given an appointment sooner than those with chronic or minor problems. This is accomplished by reserving several appointments each day for those with acute problems. See figure 3-3. The patients who need quick care are seen sooner. This system may be used in clinics with central appointment desks by giving the appointment desk a short list of questions to ask the patient. On the other hand, Patients soon "learn the system" and claim acute problems. Too, the Central appointment desk personnel may not ask the right questions of patients, or patients may not want to answer them.

Vision Screening or Survey System. This is probably the best system for initial triage on optometric patients (fig. 3-4). Unfortunately, it is not the most popular. In this system, almost all patients who request an appointment are first given a vision survey by the optometry specialist, the optometrist, or both. Some patients are given direct appointments with the optometrist when the need is obvious. Patients who need quick care are seen sooner, and the optometrist spends more time giving professional services. The waiting list for refractions is usually shorter, thus allowing clinic personnel to plan leaves and additional duties better. With a reduced demand for refractions, more time may be devoted to contact lens care, vision training, etc. On the other hand, each screening system has its own inherent disadvantages. No screening exam is as complete as a visual analysis. Many patients want to be seen by the doc-

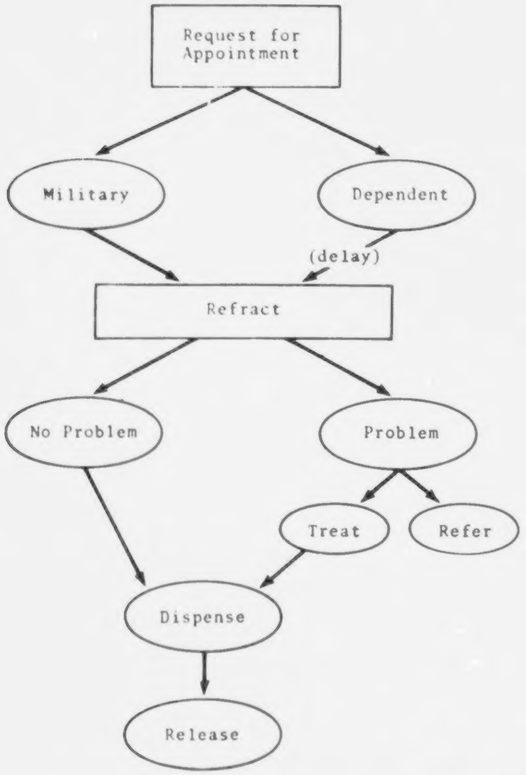


Figure 3–2. Military priority system flow chart.

tor only, and some optometrists want to do all the work on their patients. In other cases, the optometry specialist has much more work to do.

Appointment Cutoff System. Some clinics, in an attempt to keep waiting lists under a certain time limit, establish a cutoff date beyond which no appointments are made. The appointment book may be opened each Monday and kept only until the cutoff date is reached. Patients calling after the book is closed are told to call back the following week. The system offers an *apparently* moderate waiting time for refraction. Clinical personnel time may be scheduled effectively.

The disadvantages of this system are that the actual waiting time is the same as in the walk-in system, and that no actual priority has been established.

These systems may be used singly, but are usually more efficient in combination with each other. A system's suitability depends on the conditions in your clinic, and its success depends on its suitability and its vigorous application by clinic personnel.

Exercises (010):

1. Assume that you are working in a clinic with a 2- or 3-day day backlog, two optometrists, and one specialist (yourself). Which priority system or systems would you recommend for good patient flow and an equitable distribution of work? Explain your answer.

2. You have just been transferred to a clinic with one optometrist and one other specialist (AFSC 91235). There is a 2-month backlog. Which priority system would you recommend? Explain your answer.

3. You have just been transferred to a clinic that lost its optometry officer 2 months ago. A replacement is scheduled 3 months from now. The hospital commander wants you to "take care of the patients," but little money is available for TDYs or civilian consultants. What priority system would you institute? Explain your answer.

011. Cite the conditions under which an appointment would be made with the optometrist, an M.D., or the vision survey clinic.

Guideline for Initial Disposition of Patients. Not all patients who call the optometry clinic need an appointment

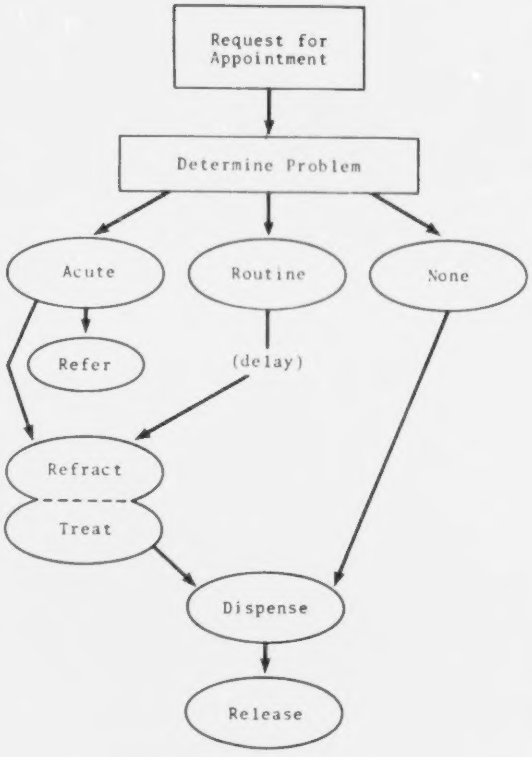


Figure 3–3. Preliminary triage system flow chart.

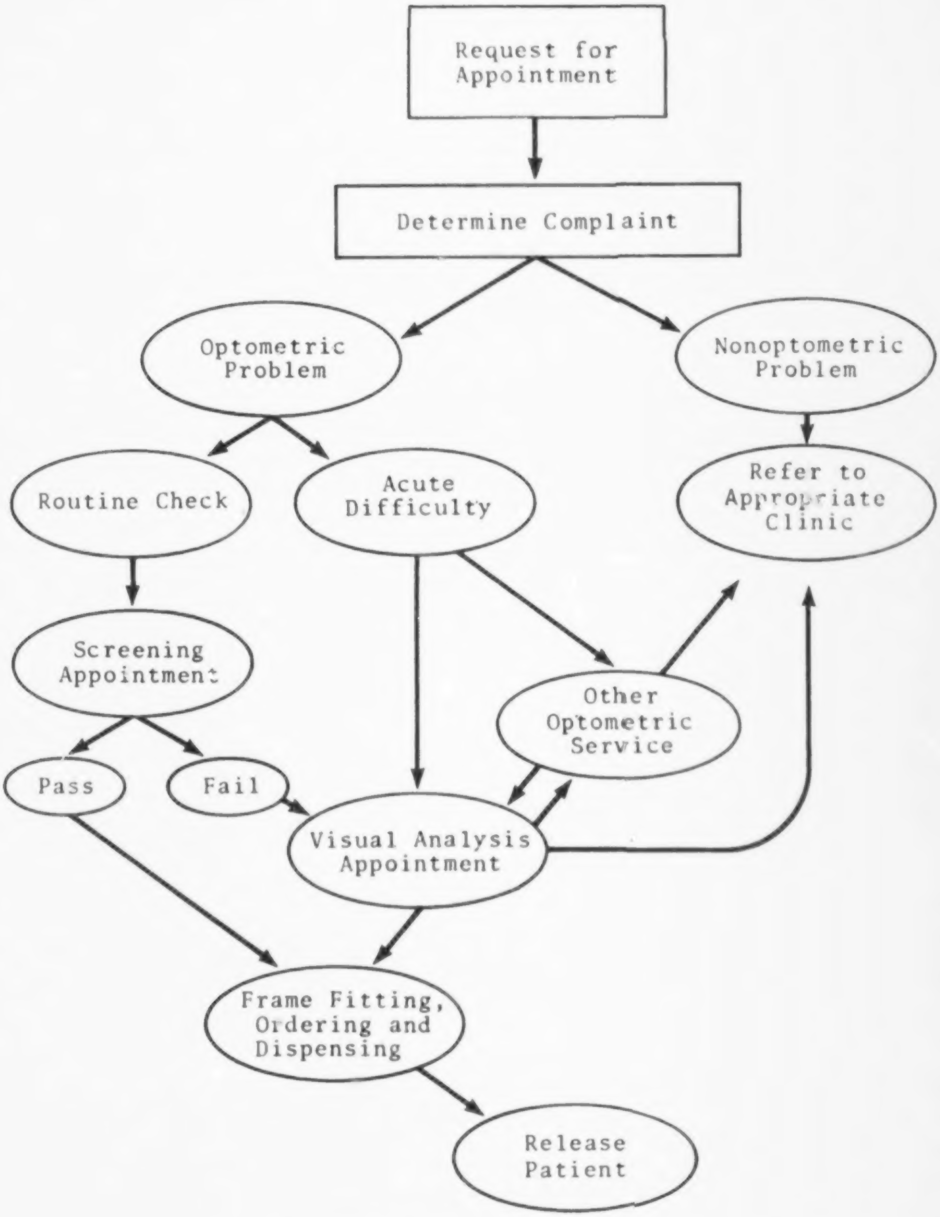

Request for Appointment
Determine Complaint
Optometric Problem
Nonoptometric Problem
Routine Check
Acute Difficulty
Refer to Appropriate Clinic
Screening Appointment
Other Optometric Service
Pass
Fail
Visual Analysis Appointment
Frame Fitting, Ordering and Dispensing
Release Patient

Figure 3–4. Vision survey system flow chart.

with the optometrist; some may be seen by the specialist or technician, and others may be referred to another clinical service. You should make this initial differentiation at the earliest opportunity, usually when the patient calls for an appointment.

If a patient with broken or lost spectacles has not had an exam for over a year, an exam by the optometrist may be in order. A referral from another clinical service (like Pediatrics) or from a school should be seen by the optometrist.

There are some cases that should go directly to an opthalmologist or M.D. Examples are symptoms of acute eye pain, red or itchy eyes, sudden loss of vision, headaches with sudden onset, and diagnosed external and internal eye diseases.

The last category of exam is that of a vision screening, or preliminary examination. Many patients have no serious complaints, but are coming in due to the span of time since their last exam, or have complaints that are vague or misleading. Screen these patients to hone in on important problems. A patient who has been examined within the last year and wants new glasses, or a person needing a vision test for driver's license renewal are just two of the many types of cases that should be screened to make better use of your time and the limited appointment space.

A few examples should give you a general guideline as to initial disposition of your patients. Let's assume that you have just answered the phone, introduced yourself, and asked the caller if you could help; the caller responds by saying "Yes, I'd like an appointment with the doctor."

You: " Is this appointment for yourself or one of your family?"
Caller: "Myself."
You: "Are you active duty or dependent?"
Caller: "Dependent."
You: "What problems are you having with your eyes."

Now here is a critical step. The "treatment path" of the patient depends on the next response. Let's look at some possible responses and the action to take.

Response	*Action*
(1) "Oh, not much, I just want my eyes checked".	Make screening appointment.
(2) "I broke my glasses."	Are the frames or lenses broken? If the lenses are broken, determine age of Rx and if satisfactory, duplication of Rx may be in order. If not, make appointment for refraction.
(3) "I can't see."	How many times have you heard this one? This joker is trying to be funny and now you have to work to find out what the problem is. If the person *really* can't see, he or she may need an emergency appointment with anyone from an ophthalmologist to a psychologist. Find out what is really wrong and follow through from there.
(4) "I failed my driver's vision test."	Make appointment for refraction.
(5) "My eyes are all red and itchy."	Make appointment for ophthalmology or other M.D.
(6) "I keep getting these headaches."	Make appointment for screening.
(7) "My glasses are getting old."	Make appointment for screening.
(8) "I need some sunglasses."	Determine currency and adequacy of present Rx. Duplication may be indicated. If not, make appointment for screening.
(9) "My glasses (frames) are broken."	Walk in for repair if standard issue frame. See local optician if civilian-style frame.

It is important to remember that most patients want to see the doctor and not the technician, so when you refer them to the screening clinic, do it tactfully. Let them know that the appointment is for a preliminary visual evaluation which will be interpreted by the doctor if they need further care.

Exercises (011):

What factors would cause you to make an appointment as follows:

1. Directly with the optometrist?

2. Directly with the M.D.?

3. For the vision survey clinic?

012. Name the elements of a no-show letter and the person to whom to direct a no-show letter in given cases.

Failure to Keep Appointments. Sometimes patients are inconsiderate. They make all kinds of trouble to get an appointment as soon as possible, then forget to keep the appointment and neglect to cancel it. This broken appointment sometimes gives clinic personnel time to catch up on paperwork and other necessary jobs, but for most clinics this means a wasted half hour. In order to avoid confusion about appointments, always repeat the date and time several times to the patient who phones in, and give the patient who makes the appointment in person an appointment slip if possible. If a patient cancels an appointment, thank her or him for calling and set up another appointment. If the patient is a habitual no-show, a letter similar to the one shown in figure 3-5 or 3-6 may be indicated. In the case of a dependent, the letter would be sent to the sponsor's OIC. When an active duty person fails to keep an appointment, the letter goes to that person's commander. Maker sure that you check with the hospital commander before using either format.

Exercises (012):

1. What elements would be appropriate in a no-show letter?

2. To whom should a no-show letter for a dependent be directed?

3. To whom should an active duty member's no-show letter be directed?

3-2. Requesting, Completing, and Disposing of Medical Records

Let's assume that a patient has arrived for treatment in the optometry clinic. Before starting treatment, you must see that the medical records are properly initiated.

013. Identify optometry-oriented forms by title and placement or position in the medical records.

Whenever a patient is treated in your clinic, you should make an entry in the medical records. Not only does this record the type and continuity of treatment for the patient, but it lets you claim that unit of treatment as a "visit" for accounting purposes. In clinics where the appointment desk makes your appointments, they should send the medical records. If a patient's records are in another clinic, you'll have to go look for them. This is why it is so important you arrive to work early. Give yourself time to organize the day's schedule. Walk-in patients can be handled a little differently. You may ask them to get their records, or you may make the entry on a properly filled out SF 600, Health Record—Chronological Record of Medical Care.

Outpatient Record Folder. Before your patients arrive, check the medical records. Do you have the right ones? For authorized patients, check the name and SSAN recorded on the outside of the AF Form 2100 series, Health Record.

DD Form 741. There are several optometry-oriented forms that you may choose from. DD Form 741, Eye Consultation, is the only AF-wide eye exam form. It is usually filed on the left side of the medical records folder, and an appropriate dated entry is placed on the SF 600, Health Record—Chronological Record of Medical Care, referring the reader to the DD Form 741.

SF 600. Some optometrists prefer to use the SF 600 as an exam form. It is filed on the right side of the folder in chronological sequence with other SF 600s. The optometrist may use an overprinted SF 600, or may transcribe the findings on a blank SF 600.

SF 513. The SF 513, Medical Record—Consultation Sheet, may be either overprinted or filled in by hand. You file them together, directly under all SF 600s, in chronological order by date of consultation, with the latest SF 513 on top.

SF 507. Sometimes you can use an overprinted SF 507, Clinical Record—Report of Continuation of SF ____________. File this form on the right side of the folder beneath other forms.

DD Form 771 and DD Form 742. Two other DD forms used by the optometry clinic are filed in the medical records folder. The DD Form 771, Eyewear Prescription, or DD Form 771-1, Eyewear Prescription Plastic Lens, should be filed on the left side of the records. The DD Form 742, Clinical Record—Visual Field Examination, should be filed on the right side of the folder beneath other forms.

Exercises (013):

What optometry-oriented forms carry these numbers?

1. 741.

2. 513.

3. 600.

4. 771.

Where do these forms go in the medical records?

5. DD Form 741.

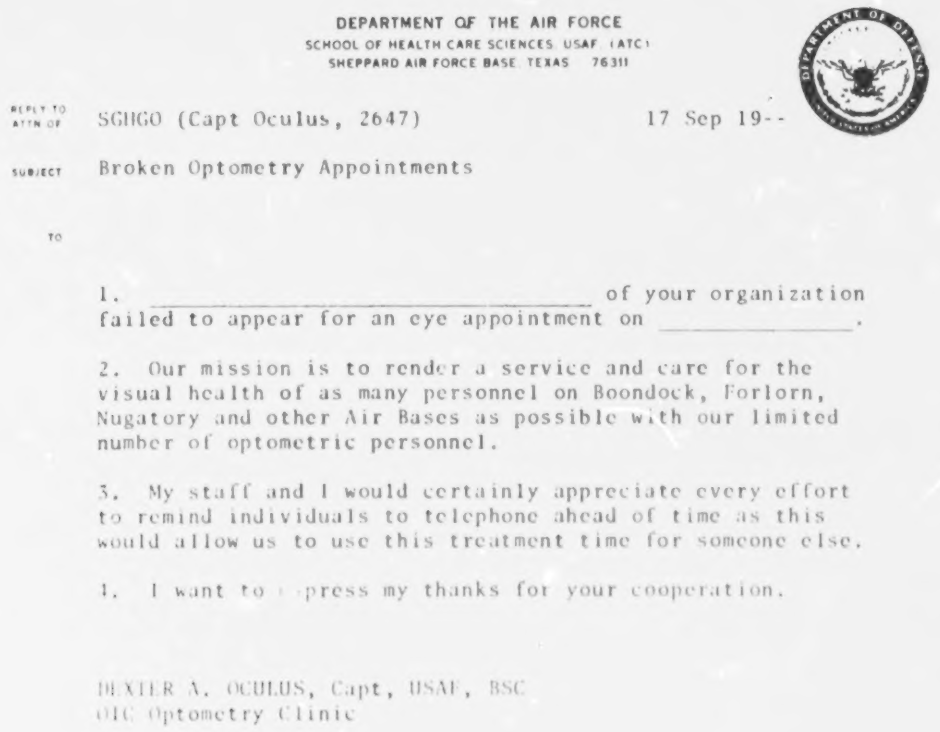
6. SF 513.

7. SF 600.

8. DD Form 771.

3-4. Patient Accounting Procedures

In addition to caring for and treating patients, we must be able to show how many patients were given treatment and what type treatment they were given. Nobody outside the



DEPARTMENT OF THE AIR FORCE
SCHOOL OF HEALTH CARE SCIENCES USAF (ATC)
SHEPPARD AIR FORCE BASE TEXAS 76311

REPLY TO ATTN OF: SGHGO (Capt Oculus, 2647) 17 Sep 19--

SUBJECT: Broken Optometry Appointments

TO:

1. ______________________________ of your organization failed to appear for an eye appointment on ______________.

2. Our mission is to render a service and care for the visual health of as many personnel on Boondock, Forlorn, Nugatory and other Air Bases as possible with our limited number of optometric personnel.

3. My staff and I would certainly appreciate every effort to remind individuals to telephone ahead of time as this would allow us to use this treatment time for someone else.

4. I want to express my thanks for your cooperation.

DEXTER A. OCULUS, Capt, USAF, BSC
OIC Optometry Clinic

Figure 3-5. No-show letter for active duty personnel.

optometry clinic will know how hard you are working if you don't tell them. Periodic reports inform USAF managerial levels of your workload and staffing needs, as well as problem areas and services performed.

014. State how to complete SF 600, Health Record—Chronological Record of Medical Care, to validate the audit trail.

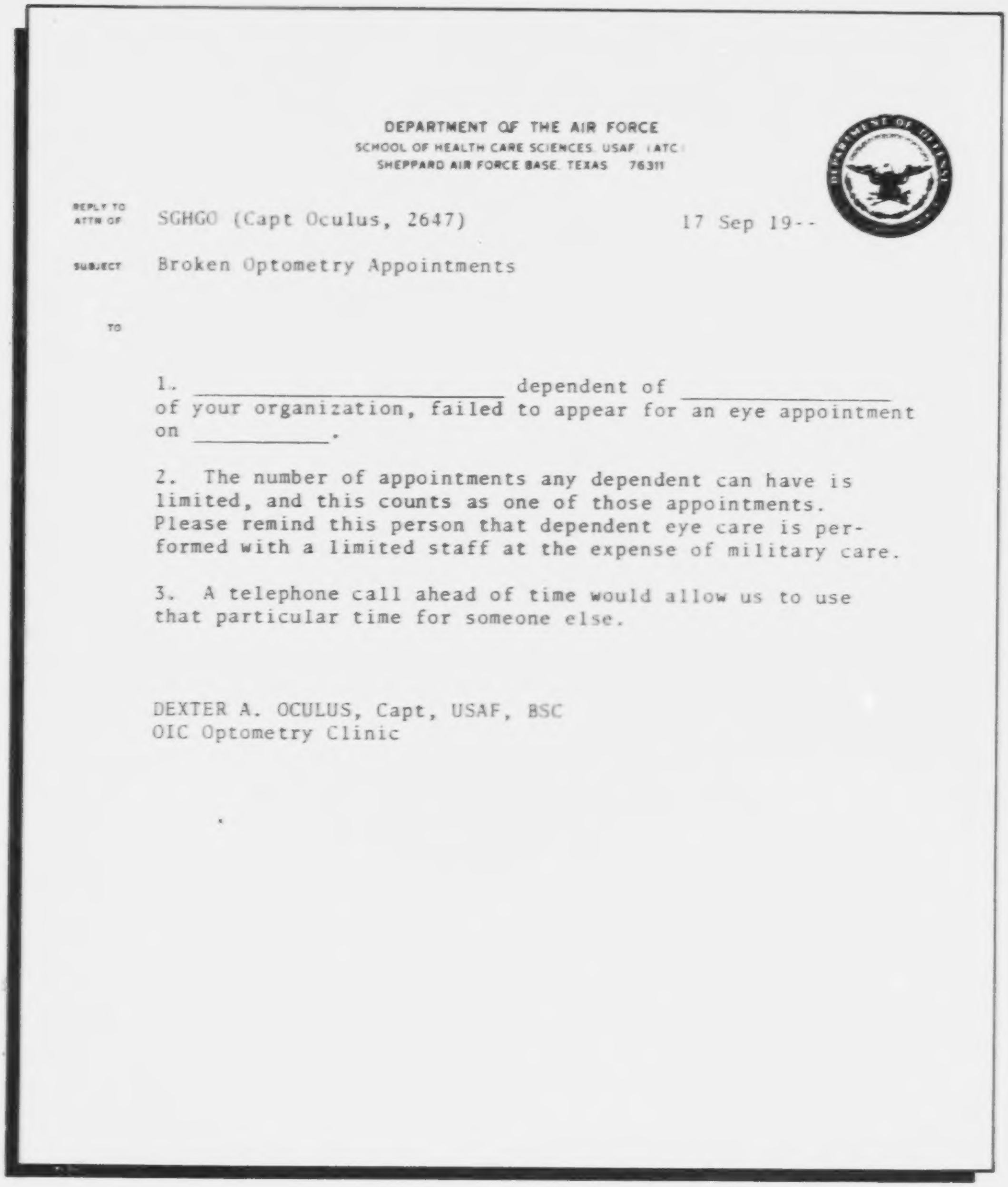
Validating the Audit Trail. To insure accurate reporting, each Air Force medical unit must have an easily audited workload collection and reporting system. AFM 168–695, *MAMS—Medical Administrative Management System—Base (PA) User's Manual,* states that the minimum acceptable system includes a log and a daily summary. The log (AF Form 555, Patient Visit Register), must indicate each patient's name, whether inpatient or outpatient, family relationship prefix, sponsor's SSAN, category of beneficiary, and date of visit. Be sure to delete "no-shows" and add "walk-ins" and telephone consultations. Note that telephone consultations may now be counted as part of your patient workload. The daily summary of visits and appointment logs goes to Resource Management on a DAILY basis. Resource Management verifies the totals on your daily appointment logs and, at the end of each month, totals all visits and enters this data on AF Form 235 or AF Form 235a, Report of Patients.

Verifying the Audit Trail. Using sampling techniques, Resource Management periodically verifies the entries on your patient logs by matching the log entries to documentation in the health record. For example, SSgt Fleisch had his spectacles adjusted in your clinic 3 days ago. You counted this as a technician visit and turned his name in as part of your daily patient count. Resource Management decides to verify your audit trail and chooses SSgt Fleisch's name for part of the sample.

They go to the records section, pull SSgt Fleisch's medical folder, checks to see whether the visit is documented (fig. 3-7), and annotate the patient log to indicate the sample and findings. The key factor in audit trail verification is *proper documentation on the health record.* Proper documentation consists of a signed, dated entry that specifically states what you did for the patient. Discrepancies uncovered as a result of this verification are reported to the medical facility administrator and chief of hospital services. You will have to explain any discrepancies that occur.

From a current newsletter to the resource management office we find that proper documentation on the health record should include date, circumstances, significant findings, diagnosis of impression, treatment given, statement regarding follow-up care (if any), and signature and stamp of provider. Most important is that it be legible to anyone with a "need to know."

Reportable Visits. The key to reporting visits is adequate documentation on the patient's medical record. This means that all visits to your clinic are reportable, provided that you document the visit to support an audit



DEPARTMENT OF THE AIR FORCE
SCHOOL OF HEALTH CARE SCIENCES, USAF (ATC)
SHEPPARD AIR FORCE BASE, TEXAS 76311

REPLY TO ATTN OF: SGHGO (Capt Oculus, 2647) 17 Sep 19--

SUBJECT: Broken Optometry Appointments

TO:

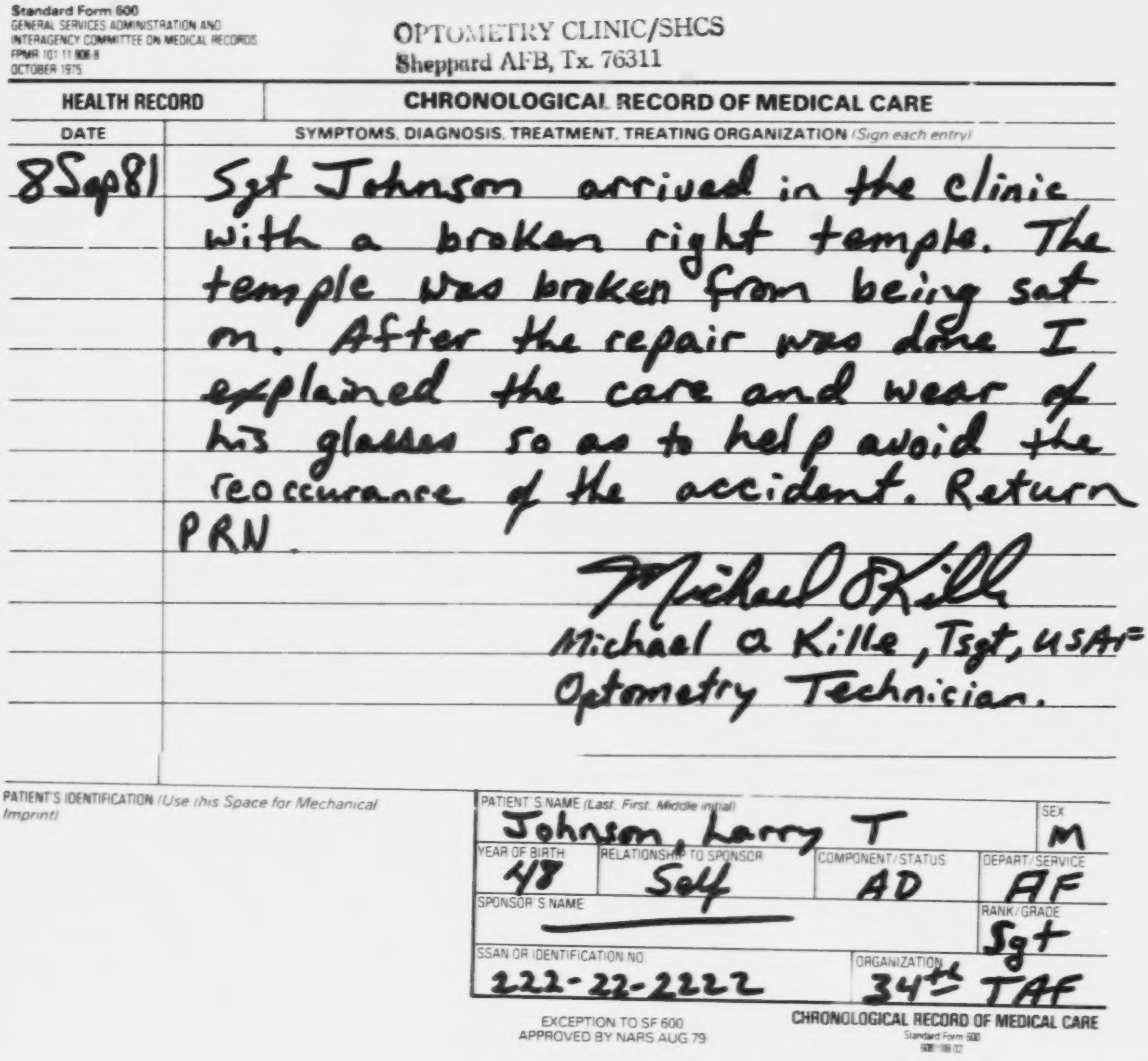
1. ______________________ dependent of ______________ of your organization, failed to appear for an eye appointment on __________.

2. The number of appointments any dependent can have is limited, and this counts as one of those appointments. Please remind this person that dependent eye care is performed with a limited staff at the expense of military care.

3. A telephone call ahead of time would allow us to use that particular time for someone else.

DEXTER A. OCULUS, Capt, USAF, BSC
OIC Optometry Clinic

Figure 3–6. No-show letter for dependents.



Standard Form 600
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101-11.806-8
OCTOBER 1975

OPTOMETRY CLINIC/SHCS
Sheppard AFB, Tx. 76311

HEALTH RECORD | **CHRONOLOGICAL RECORD OF MEDICAL CARE**

DATE	SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION *(Sign each entry)*
8 Sep 81	Sgt Johnson arrived in the clinic with a broken right temple. The temple was broken from being sat on. After the repair was done I explained the care and wear of his glasses so as to help avoid the reoccurance of the accident. Return PRN.
	Michael O Kille
	Michael O Kille, Tsgt, USAF Optometry Technician.

PATIENT'S IDENTIFICATION *(Use this Space for Mechanical Imprint)*

PATIENT'S NAME *(Last, First, Middle initial)*: Johnson, Larry T
SEX: M
YEAR OF BIRTH: 48
RELATIONSHIP TO SPONSOR: Self
COMPONENT/STATUS: AD
DEPART/SERVICE: AF
SPONSOR'S NAME: —
RANK/GRADE: Sgt
SSAN OR IDENTIFICATION NO: 222-22-2222
ORGANIZATION: 34th TAF

EXCEPTION TO SF 600
APPROVED BY NARS AUG 79

CHRONOLOGICAL RECORD OF MEDICAL CARE
Standard Form 600
[illegible] 02

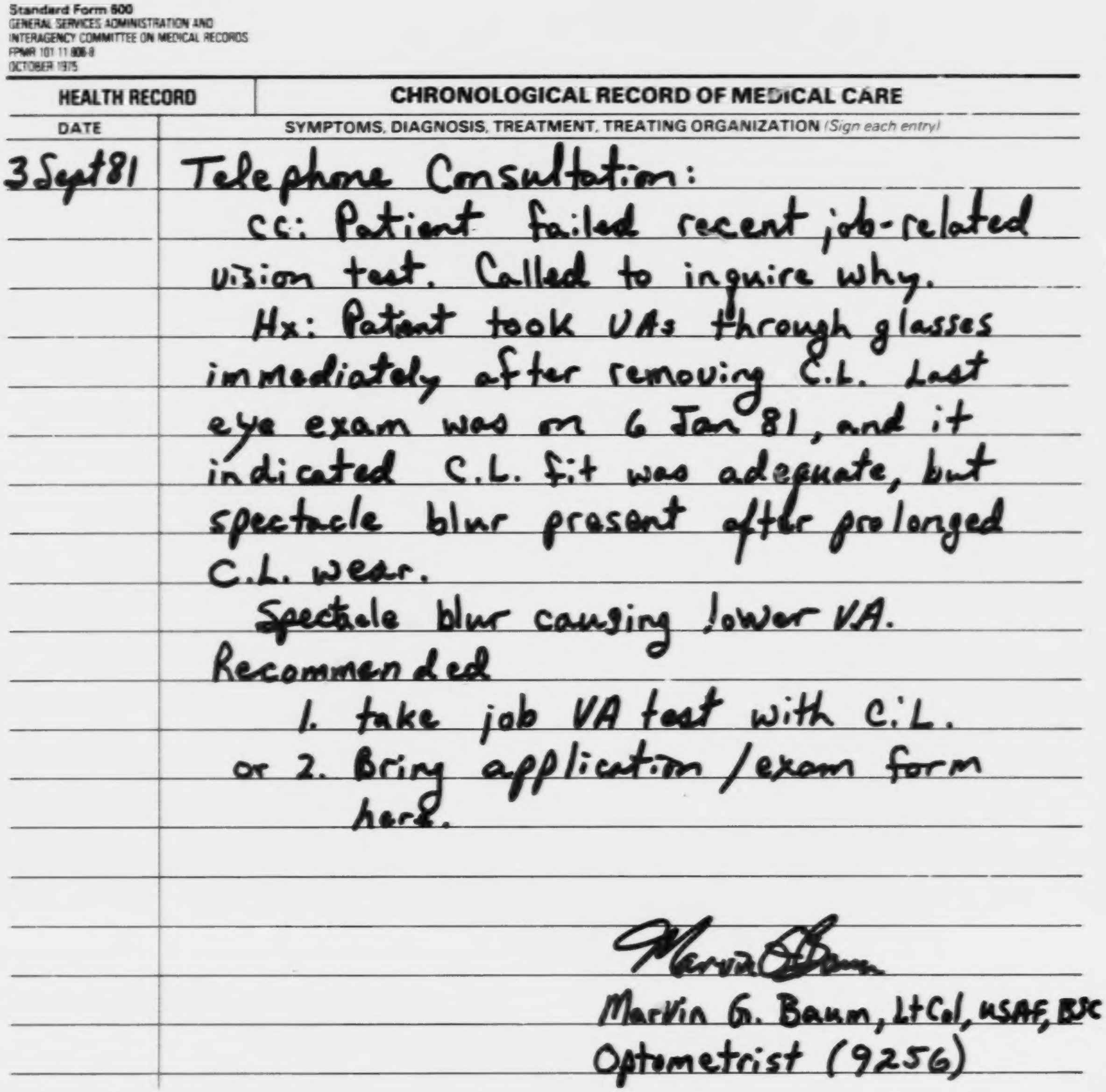
Figure 3-7. Proper documentation of patient visit.

trail. Now let's see what AFM 168-695 says about patient visits.

Reportable visits for the optometrist. You must keep two separate patient counts for your optometrist. One count consists of the number of refractions done as part of a complete visual examination and includes cycloplegic refractions. The accuracy of this count is extremely important because it is the basis of your clinic manning. The second count consists of all other patients your optometrist sees; for example, contact lens checks, visual training patients, and maybe even telephone consultations. Again, the key to counting telephone consultations is proper documentation in the patient's medical record (see fig. 3-8 and 3-9). All of these additional "visits" must be written in on your optometrist's daily patient log.

Reportable technician visits. All of the patients that you see, including telephone consultations, are reportable as technician visits—providing you document the medical record. These visits must be written in on the technician's daily patient log and are turned in to the Resource Management office at the end of each day.

Double counting. Finally you must be very careful about not double counting patients seen in your clinic. For example, when both you and your optometrist see the same patient on the same day, the visit should be reported on the log of whoever provided principal care to the patient. When your role consists of a preliminary exam with referral to your optometrist, count this as a visit to your optometrist. When you provide the principal care or service, count this as a technician visit. You may also count all visits in which



Standard Form 600
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101 11 806-8
OCTOBER 1975

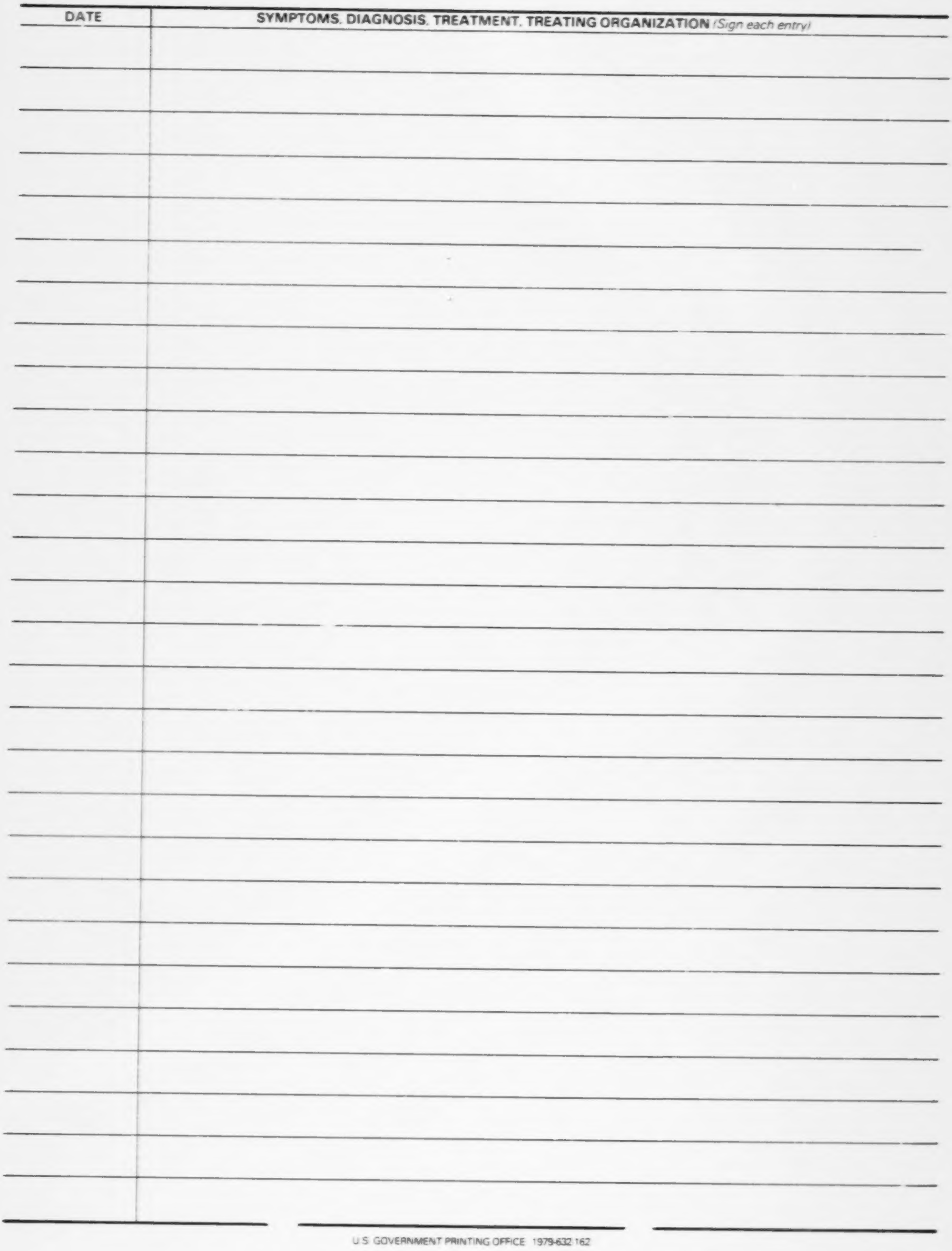
HEALTH RECORD	CHRONOLOGICAL RECORD OF MEDICAL CARE
DATE	SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION *(Sign each entry)*
3 Sept 81	Telephone Consultation:

CC: Patient failed recent job-related vision test. Called to inquire why.

Hx: Patant took VAs through glasses immediately after removing C.L. Last eye exam was on 6 Jan 81, and it indicated C.L. fit was adequate, but spectacle blur present after prolonged C.L. wear.

Spectacle blur causing lower V.A.
Recommended
1. take job VA test with C.L.
or 2. Bring application/exam form here.

Marvin G. Baum
Marvin G. Baum, LtCol, USAF, BSC
Optometrist (9256)



DATE	SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION *(Sign each entry)*

U.S. GOVERNMENT PRINTING OFFICE 1979-632 162

Figure 3–9. SF 600 (reverse side).

you perform preliminary examinations with referral to a physician or extender in another clinic.

Exercises (014):

Complete the following questions dealing with an SF 600, Health Record—Chronological Record of Medical Care.

1. A summary of each day's visits and appointment logs are sent to ____________ ____________.

2. During an audit trail, the inspector is looking for the key factor of ____________ ____________.

3. When a patient is seen by you, but given the primary treatment by the doctor, who counts the patient's visit?

4. The most important part of any handwritten report is ____________.

Facilities and Personnel

AS YOU remember from the section on duties and responsibilities of the 5 level, you are expected to assume greater supervisory responsibilities as you progress up your career ladder. This chapter will introduce you to some of these supervisory functions and explain why they are necessary.

4-1. Housekeeping

How often have you formed a lasting impression of some place by its appearance the first time you saw it? First impressions are important, especially when the person forming that impression may not have a chance to change it. A prime example is the optometry clinic. A patient may form some rather strange ideas about the quality of eye care if the first impression is one of a dingy, messy office and a dark, dank eye lane. Studies have also shown that working in a sloppy environment often seems to encourage sloppy work. It's easier to maintain good personal and patient relationships in an environment that reflects professionalism.

015. List specific housekeeping tasks to perform before, during, and after opening the optometry clinic for patient treatment.

Clinic housekeeping chores are usually not too enjoyable, but they are necessary; and if you keep up on a daily basis, you won't have to borrow a bulldozer from CE for your periodic major cleanups. Let's look at some of the things you should do on a daily basis.

Before Patients Arrive. Instead of coming in at clinic opening time, arrive a few minutes early and, while you are fortifying yourself with a cup of coffee, check to see that the area is ready for the day's patients.

(1) Is the reception area relatively neat? Are your logbooks properly placed, and paperwork filed? If there are ash trays in the area, are they clean? Is the furniture orderly?

(2) Is the frame warmer on? Have you turned on necessary equipment and lighting?

(3) Are the instruments uncovered? Wipe them off if necessary. Change faceplates in the phoropter unit. Clean head- and chinrests in the slit lamp, keratometer, and perimeter.

(4) How are the atmosphere and temperature? Adjust the heating and ventilation. Spray a little air freshener if necessary.

(5) Are the medical records ready? Check to see if all of the records have arrived. Start completing exam forms on the first few patients.

During the Day. Try to keep ahead of the mess by performing a few clean-up duties when you have time.

(1) Keep your desk and the dispensing area clean. Cigarette ashes and salt from the frame warmer may have a tendency to spread.

(2) Fill out exam forms before the patient arrives. You know that there are times when patients are literally climbing all over the place. Try to plan ahead so you won't be rushed at a critical time.

(3) Clean the frames in the dispensing area. One patient may not appreciate the greasy kid stuff left on a frame by another patient.

(4) Try to keep your frame adjusting tools orderly and clean. Patients are turned off when you dig through a dirty drawer to find a rusty pair of pliers with which to adjust their frames.

(5) Wipe up any chemical or water spills. Keep wastepaper and used carbons in the wastebasket. Don't leave rubber bands from the spectacle cases lying around.

At the End of the Day. Before you take off for home, check your area again.

(1) Have the medical records been properly annotated and made ready for the records room? Has the optometrist signed the order forms and are they ready to mail to the lab? Have the next day's records been requested?

(2) Is all equipment turned off? Save energy by turning the frame warmer off. Make sure the projectochart and hand instruments are off, and that the chairs are down.

(3) Cover all equipment and instruments. Make sure the phoropter is set at zero and the occluders are closed—the lenses will stay clean longer.

(4) Put away all logbooks, clean up the dispensing area, straighten up the furniture, close the windows, turn off the light, disconnect all electrical equipment and lock all the doors as you leave.

Periodic Cleanups. Although janitorial services will take care of most of the heavy cleaning, it is usually a good idea to schedule an office GI party once in a while. You may want to rearrange the furniture, polish all the desks and tables, and clean out the paper clips from under the rug. If you are really feeling energetic, you might even schedule a self-help painting project or cover the furniture with wood-grain vinyl. Don't forget to check local policies before "improving" your office.

Exercises (015):

You have arrived at your clinic a few minutes early. In exercises 1-3, indicate the items you should check in each specific area to assure yourself that the clinic is ready for patients.

1. Reception area.

2. Examination area.

3. Dispensing area.

4. What specific tasks can you do to reduce patient waiting time and extend your availability for other clinic functions?

5. What end-of-day items should you check to assure yourself that you have completed all housekeeping tasks for the day?

4-2. Standing Operating Procedures (SOPs), Operating Instructions (OIs), and Hospital Regulations

At this stage in your AF career, you may have made one or more PCSs or at least a visit or two to other optometry clinics. If so, you have probably noticed some differences in operation. After arrival at a new clinic, your effectiveness may have been reduced for a while as you absorbed new policies and forgot old ones. One way to reduce the loss of effectiveness is to prepare an SOP for your clinic and any new personnel.

016. Explain the purpose of and list general items to be included in a written SOP; and distinguish between SOP and OI.

Purpose of an SOP. Although general optometry clinic procedures are pretty much standardized throughout the Air Force, each clinic may have its own special way of doing some tasks. Quite often a new worker has some trouble adjusting to the new situation because of unfamiliarity with local procedures or policies. Usually, the new airman learns these new ways of doing things by trial and error, which is obviously inefficient. One thing that will make adjusting easier for new personnel at your clinic is the SOP—a document that tells the reader what the clinic does and how some things are done. Each clinic will probably have a different format for its SOP, and the example in Appendix B should give you an idea of what to include.

Preparation of an SOP. Although there are no Air Force directives on SOP preparation, many hospitals have a local directive concerning style and content of the SOP. Appendix B contains a sample SOP for a USAF base, and uses these headings:

a. Introduction—a concise statement as to the purpose of the clinic.

b. Duty hour—since duty hours vary from base to base, the new worker will find this section helpful.

c. Manning—how many people work full or part-time in the clinic.

d. Services performed—what services are available in your particular eye clinic.

e. Personnel authorized optometry care—who can receive care and what priority exists in the appointment system.

f. Appointments—how patients may receive an appointment.

g. Occupational Safety Program—policies and procedures.

h. Special Order Spectacle Program—availability and information.

i. Spectacle ordering and dispensing—references and tips.

j. Contact lenses—policies and procedures.

k. Referral service—for medical/ophthalmologic problems.

l. Operating procedure—a description of general procedures to follow in patient processing.

m. Count of patients—a list of forms, due dates, and procedures.

n. Ordering supplies and equipment—"shopping dates" and forms to use.

Since both enlisted personnel at the cited clinic were 91255s, the SOP was a list of "what to do" rather than "how to do it." If your clinic has some part-time help, you may wish to include a "how to do it" section.

Operating Instructions and Hospital Regulations. The SOP is not a standard publication, although AFR 5-1, *Air Force Publications Management Program*, states that operating instructions and hospital regulations are. Operating Instructions are directives that apply to a specific clinic. They are written by the OIC for personnel of that clinic, using a format prescribed in AFR 5-1.

Hospital regulations are local directives on specific policies and procedures, written under the approval of the hospital commander, using the format prescribed in AFR 5-1. Your clinic may find it necessary to write a supplemental hospital regulation on local policies and procedures concerning visual screening program, and contact lens services. Since both operating instructions and hospital regulations are prescribing directives, they must be maintained in accordance with AFR 5-1, and are subject to periodic inspection and revison.

Exercises (016):

1. What is the purpose of the SOP?

2. List general topics which any optometry clinic may include in an SOP.

3. What are the two differences between an SOP and an operating instruction?

4-3. Duty Rosters, Position Descriptions, and Clinic Manning

Does your clinic have enough 912X5 authorizations to handle your daily workload? Do you have a screening program? What is your patient backlog? You and your optometrist should give these questions some serious consideration. If you are having difficulty in any of these areas, you just might be able to justify an additional 912X5 authorization.

017. State how to prepare and use duty rosters and position descriptions.

Basic Data. To prepare a duty roster or position description, you have to know what tasks need to be done in your clinic. You can get some help by reviewing your clinic SOP and by reading your STS which is in your OJT folder. Have the workers list each job they do, no matter how large or small (see fig. 4-1). This list may include items not found in your STS and may be worded quite differently from clinic to clinic. Estimate the total time spent on each task as accurately as possible and enter the number of units produced for the period; for instance, under "spectacle verification" you may enter "8 hrs/week" and "100 pair," or whatever agrees with your actual workload. Once these lists are complete, you have all the necessary data to identify the work distribution in your clinic. You will be able to see if there is any misdirected effort (nonessential work), if the work is distributed equitably, if skills are being used properly, if tasks are spread too thinly, and what tasks take the most time; you should also be able to answer the questions at the beginning of this section.

Duty Roster Preparation. If you are the only 912X5 in your clinic, the duty roster may be as simple as a calendar sheet with your name and duty hours entered for each duty day; however, be sure and enter the names and duty hours of your part-time help; the 902s on loan to your clinic and the Red Cross volunteers who come in each day. On the other hand, you may work in a multiple-technician clinic. If so, you may want to break down each job and assign a worker to that position. You may assign "reception area," "dispensing room," "preliminary testing," "visual screening," or any generalized term to a group of specific tasks done by one person. Don't forget to include the overlapping tasks under each general term.

Figure 4-2 lists tasks done in a hypothetical dispensing room. This list may be posted to insure that clinic personnel are familiar with the duties for any particular section. Use of such task lists would eliminate the necessity of any statement other than the general position and worker's name on your duty roster. Preparing a roster this takes time, but you seldom redo it. Listing the tasks and who is to do them will save effort in the long run because everybody will know exactly to do, and time won't be wasted on "goofing off" while the less popular tasks are left undone. In addition, the task list will also you identify and support the need for additional 912X5s if your workload so indicates.

Position Description Preparation. Although your STS lists what you are trained to do, it does not show what you actually do at any particular clinic. Some technicians may have never done electronic tonometries, but may be completely familiar with frame bending. Others may know how to fill out a DD Form 771, but have forgotten how to take visual fields. If you prepare a position description, list the tasks that are or need to be done in that position. Don't be like Sergeant Spectacle in figure 4 3 and assign impossible tasks, but use your STS and task lists to write a comprehensive specific duty description along the lines of the general duty description found in *AFR 39–1, Airman Classification Regulation* for your AFSC. Later, when you study for your 7 level, you will receive more information on these supervisory aspects of your job. Civilian position description requirements are found in AFR 40–414, *Employee Orientation*, so if your hospital is thinking about hiring a civil service dispensing optician, you can use AFR 40–414 and the working area task listing to write a list of requirements and abilities for the job applicant.

Exercises (017):

1. As an optometry specialist supervising a 91235 and a part-time Red Cross worker, how can you tell exactly what work each person does in your clinic (other than the ODS)?

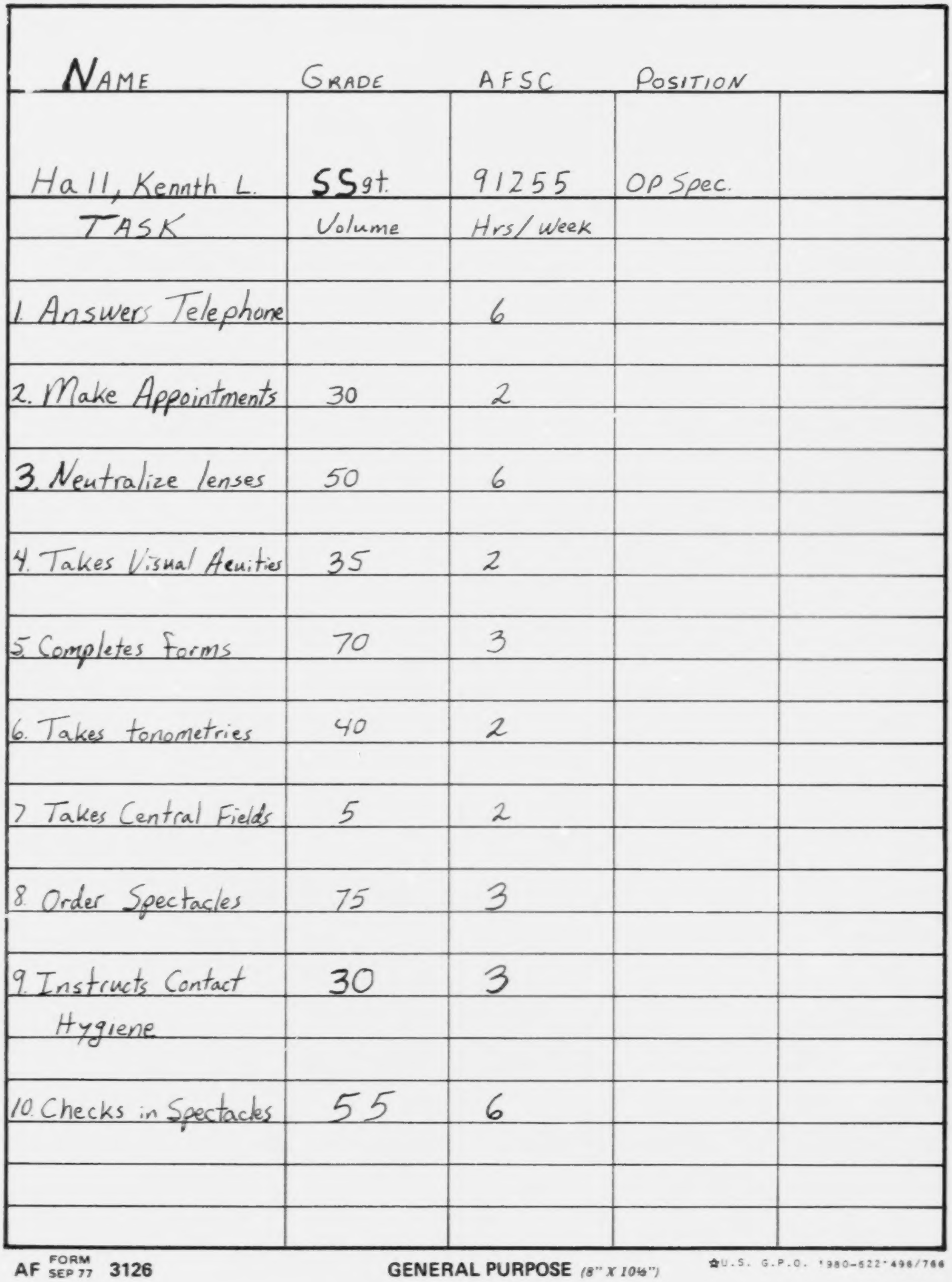
2. What is the purpose of the consolidated list of tasks?

3. What is the purpose of a position description?

018. State what factors you consider in requesting additional 912X5 positions for your clinic.

Feedback from optometry clinics and AF HQ indicates a balanced field of technicians. This may be true for the most part, but some clinics are still understaffed. Let's see how you might prepare a request for more 912X5 authorizations and trace the path that your request would follow.

Manpower Authorization Source Documents. AFM 26–3, *Air Force Manpower Standards*, and AFM 168–695, *MAMS Medical Administrative Management System*, are



NAME	GRADE	AFSC	POSITION	
Hall, Kennth L.	SSgt.	91255	OP Spec.	
TASK	Volume	Hrs/Week		
1. Answers Telephone		6		
2. Make Appointments	30	2		
3. Neutralize lenses	50	6		
4. Takes Visual Acuities	35	2		
5. Completes Forms	70	3		
6. Takes tonometries	40	2		
7. Takes Central Fields	5	2		
8. Order Spectacles	75	3		
9. Instructs Contact Hygiene	30	3		
10. Checks in Spectacles	55	6		

AF FORM SEP 77 3126 GENERAL PURPOSE (8" X 10½") ☆U.S. G.P.O. 1980-622-496/766

Figure 4–1. Sample task list.

DISPENSING ROOM DUTIES

Verify incoming glasses.

File verified glasses.

Pull completed order forms from "spectacles on order" filebox and file in "spectacles received" filebox.

File 3rd copy of new order forms in "spectacles on order" filebox.

Maintain spectacle order logbooks.

Fit patients with spectacle frames.

Measure and record PDs.

Transcribe prescription data from exam form to spectacle order form.

Adjust and repair spectacles.

Maintain a listing of backordered spectacles.

Assist in contact lens patient instruction.

List and order replacement parts and supplies for dispensing room.

Maintain cleanliness and order of dispensing room.

Figure 4–2. Sample task list-dispensing room.

the directives that control optometry clinic manning. AFM 26–3 states that a certain number of "refractions" must be done each month to authorize "slots" for your clinic.

Refractions Per Month	*Authorizations*	
	Optometrists	*Technicians*
0–94	1	0
95–268	1	1
269–496	2	1
497–766	2	2
767–1073	3	2

AFM 168–695 specifies that optometry clinics report the number of refractions done as part of a complete visual examination, including cycloplegic refractions, but not any other procedures. These refractions are entered on line 65, AF Form 235, Report of Patients.

Since there is no Air Force definition for "refraction," let's adopt as a working definition "a test or series of tests performed (by an optometrist) to determine the presence or degree of refractive error." Thus, the entry on line 65, AF Form 235, is the monthly number of patients the optometrist saw to determine the presence or degree of refractive error. Your clinic is staffed on the number of refractions each month; no other patient visits may be counted.

How To Request Authorization. Since the key to optometry clinic staffing is the number of refractions your optometrist does each month, your first step must be to increase monthly refractions. Your optometrist might decide to eliminate all "contact lens," "visual fields," "vision training," and other special clinics and schedule refractions during these time periods. She or he might shorten the time alloted for each refraction, schedule more refractions each day, and have you do part of the exam. The clinic might give up the afternoon off (if there is one) and schedule refractions for that time period. The clinic might work longer hours each day. You can also increase the

KEEP YOUR
NOSE TO THE GRINDSTONE
EYES ON THE BALL
SHOULDER TO THE WHEEL
CHEST OUT STOMACH IN
EYES OPEN
KEEP
BOTH HANDS ON THE WHEEL
BOTH FEET ON THE GROUND
KEEP YOUR HEAD DOWN
EARS OPEN
MOUTH SHUT
UNCOMFORTABLE, ISN'T?

Figure 4–3. Sergeant Spectacle's dispensing room.

monthly count by filling "no-show" slots. Keep a list of hospital personnel who need refractions and call these individuals to fill "no-show" vacancies.

Collect Your Data. Copies of submitted AF Forms 235, recent UDLs (Unit Detail Listings) used, and applicable Manpower Standards Code will be needed. Other data should include an estimate of backlog in manhours per month, an estimate of the rate of change of this backlog, a minimum of 6 months data on overtime performed, and the number of personnel borrowed from other functional areas. Submit a letter through channels (usually to the Manpower Engineering Detachment through the Medical Resource Management Office) explaining what slot is needed, why you need it, and justify this need—quoting applicable standards in AFM 26–3. Don't forget to keep a copy of this letter.

Route of the Manpower Change Request (MCR). Medical Resource Management will consolidate your data and submit an MCR according to local directives through channels to appropriate staff agencies for review and indorsement. Eventually, the request will reach the Manpower Engineering Detachment (MED) assigned to your base. If MED approves your request, they will forward it to your command HQ for evaluation and action. If command HQ approves and has the available resources, they will revise the base MPAD (Military Personnel Authorization Document), and show an authorization for a 912X5 for your clinic. At the same time, HQ USAF will be notified of the additional slot. HQ USAF will then initiate procedures to supply a "body" to fill the slot. This may entail increasing the TPR (Trained Personnel Requirement) or may simply involve a transfer. If the TPR is increased, the School of Health Care Sciences will eventually be authorized a slot for a student optometry specialist. If this slot can be filled by a student and if this student graduates, the graduate will be available to your command. If your command HQ feels that your clinic has the most justification for a 91235 of all optometry clinics under its jurisdiction, you will eventually get the help you requested.

Just how long will all this take? Consider a minimum of 3 fiscal quarters to obtain the new authorization and a minimum of 2 quarters to find and train a student. Sometimes these lag times run concurrently, so the slot and the assignee will arrive at about the same time. If your hospital commander is extra helpful, he or she may cause this period to be shortened somewhat. "Aha!" you say,

"So even if I go through all that hassle, I might have to wait a year for help! Why should I go to the trouble?" The only way to let the Air Force know of your need is to request additional authorizations so HQ can become aware of the actual situation in the field. Your representatives at your command HQ, ATC, and HQ USAF can help, but the basic work is up to *you*.

Exercises (018):

1. What directives control optometry clinic manning?

2. How do you find the number of 912X5s authorized in your clinic?

3. What steps might your optometrist take to increase refractions per month?

4. If your request is approved, how long will it take to get another 912X5 assigned to your clinic?

4-4. The Airman Performance Report (APR) and Weighted Airman Promotion System (WAPS)

As a 5 level you probably won't have much opportunity to write APRs, but you should be familiar with this document and the WAPS because of their extreme importance in your military career.

019. Define terms associated with an APR, and indicate advantages and significant features of the Weighted Airman Promotion System.

The Airman Performance Report. This very important document is used in a number of personnel actions, including classification, assignment, promotion, training, and elimination from the service. AFR 39–62, *Noncommissioned Officer and Airman Performance Reports*, explains how to complete these forms properly. Some people, both raters and ratees, have problems defining certain terms used in the APR. Let's briefly define the main ones.

Initial indorsing official. The person immediately supervising the reporting official on the closing date of the report.

Additional indorsing official. Any person at a higher echelon in the chain of command than the initial indorsing official who adds a subsequent indorsement to an APR.

Mandatory indorsing official. Any person directed by proper authority to indorse an APR.

Period of supervision. The number of days during the reporting period that the ratee was under the supervision of the reporting official.

Ratee. The individual being rated.

Reporting official. The commissioned officer, warrant officer, NCO, or equivalent civilian of officer or NCO grade who is designated the immediate supervisor of the ratee.

Significant disagreement. Disagreement (by an indorsing official with ratings made by the reporting official or a previous indorsing official) that results in a change in Section III of three or more boxes in any item, or one or more boxes in any three or more items; or a change in Section IV of one or more boxes.

Referral report. An APR containing an entry by a rating official in Section IV in either of the two lower rating boxes (boxes 0 or 1), a rating in the lowest block (excluding "Not Observed") in any one item of Section III, or a comment in any APR or attachments that includes a statement reflecting that the personal conduct, character, integrity, or performance of the ratee is below minimum acceptable standards.

Uses of the Airman Performance Report. The APR is used as a measure of your past job performance. It reflects the sum total of your capabilities as demonstrated in your daily actions. It also serves as an indication of your expected duty performance in future assignments within your career field. More than one-fourth of the possible WAPS score is the 135 points maximum allowed for APRs. The point score is computed by multiplying by 15 the sum of the overall evaluation on the APRs you have received over the past 5 years (not to exceed a total of 10 APRs) and then dividing by that number of APRs.

Weighted Airman Promotion System (WAPS). Promotions to staff sergeant, technical sergeant, and master sergeant are under the Weighted Airman Promotion System (WAPS). Under this system, personnel data elements are collected, validated, processed, and converted to weighted factor scores for promotion selection purposes. Table 4-1 shows the WAPS scoring system.

Advantages of WAPS. The WAPS is an outgrowth of several years of study and work to devise an equitable promotion system that provides uniform Air Force-wide application of selection criteria. This helps to insure that each Air Force member receives fair and equal consideration for promotion. The WAPS also presents two other important advantages. One is what personnel people call "visibility." A major irritant of past promotion systems has been the everpresent unanswered question: "Why didn't I get promoted?" Under the WAPS people know why they are not selected, how far they missed selection, and the specific areas in which they need to improve. Another advantage is that the WAPS allows greater objectivity. Since a specified number of points are allowed in specified areas, little is left to human interpretation or subjective judgment.

The number of promotions to any grade is based on the total Air Force vacancies in that grade. An airman competes for the vacancies with all other airmen who have the same grade and the same Control Air Force Specialty Code (CAFSC). All airmen enjoy equal selection opportunity.

TABLE 4-1

WAPS SCORING SYSTEM

Factor	*Maximum Points*
Specialty Knowledge Test (SKT) Score	100
Promotion Fitness Examination (PFE) Score .	100
Time in Service	40
Time in Grade	60
Decorations	25
Performance Reports	135
TOTAL	460

For example, if 8 percent of the airmen Air Force-wide can be promoted to the next higher grade, then at least 8 percent of the airmen eligible in every CAFSC will be promoted. In the case of tie scores, everyone who has the cutoff score will be promoted even if it means promoting slightly more than the Air Force-wide selection percentage.

Two of the keys to success in WAPS are the tests that eligible airmen in grades E-4 through E-6 must take at least annually in competition with all other airmen in the same grade and AFSC. You will be scheduled for testing by your CBPO. It is the individual's responsibility to meet the scheduled testing. If you do not comply with the testing schedule issued by the CBPO, you will become automatically ineligible for promotion. However, if your commander recognizes a valid reason for you to miss your scheduled testing, he or she can request a waiver through the CBPO from the major command. You will be notified when you are scheduled to take the promotion tests; however, if you are going TDY or PCS or will be on leave, you must contact the CBPO so that you can schedule the test before you leave.

Specialty knowledge test (SKT). All airmen eligible for promotion to E-5 through E-7 take an SKT annually if one is published (or each time a new test is published in your AFSC). The SKT measures specialty knowledge in the airman's career field specialty. Anyone in a retraining status on the promotion eligibility cutoff date is exempt from taking the SKT and is put in an SKT-EXEMPT status for a maximum of 1 year (two promotion cycles), figured from the date of entry into retraining. Retrainees in this SKT-EXEMPT status will be considered for promotion under WAPS in their career field (first two digits of their AFSC) as a separate group minus the SKT score. A promotion quota proportionate to that allotted for nonretrainees in the same grade will be authorized for retrainees in each career field. All retrainees *must* take the Promotion Fitness Examination (PFE). When the SKT did not exist for your AFSC, both the retrainees and the fully qualified airmen competed together for promotion. In this case, there were not two separate categories for selection, but one, in which all eligibles competed with only the PFE.

Promotion fitness exam (PFE). The PFE measures your knowledge of military subjects and management practices at a specific grade level. As with the SKT, all eligible airmen competing for promotion to E-5 through E-7 will take the PFE annually (or each time a new PFE is published). Once taken, the test results are usually valid for two cycles.

Test scores. Under the WAPS, "percent correct" scores are used. For example, if you answer 82 percent of the test questions correctly, you will receive 82 points; 42 percent of the questions answered correctly will equal 42 points; etc.

Time in service (TIS). Time in service is computed by awarding 1/6 of a point for each month of active Federal military service up to the total possible score of 40 points for 20 years of active service as of the last day of the month of the promotion cycle. A period of 15 or more days counts as 1/6 point, and periods of less than 15 days are dropped.

Time in grade (TIG). Time-in-grade score is computed using date of rank in current grade at the rate of 1/2 point per full month ingrade up to the maximum of 60 points for 120 months ingrade. A period over 15 days of a month counts as a whole month.

Decorations. Decorations are assigned specific points according to their order of precedence. A total of 25 points is the maximum for this factor. Points allowed for each award are: Medal of Honor, 15; Air Force Cross, 11; Navy Cross, 11; Distinguished Service Medal, 9; Silver Star, 9; Legion of Merit, 7; Distinguished Flying Cross, 7; Airman's Medal, 5; Soldier's Medal, 5; Bronze Star, 5; Meritorious Service Medal, 5; Air Medal, 3; Commendation Medal, 3; and Purple Heart, 1. The same points are given for repeat awards and equivalent decorations earned in other U.S. Services, regardless of the grade held at the time earned. Decorations are used in the promotion process when the closing date of the period of the decoration is on or before the established promotion eligibility cutoff date, regardless of the date of the orders.

Selection procedures. Airmen are aligned in promotion priority order by grade, AFSC, and total weighted factor score. Those with the highest scores in each AFSC are selected to fulfill the forecast vacancies. A list of promotion selectees is published alphabetically with priority sequence numbers established by seniority (time in grade).

Exercises (019):

1. What is an initial indorsing official?

2. What is a reporting official?

3. What is significant disagreement?

4. Name three advantages of the WAPS.

5. How many points are possible under the WAPS for time in service? How are the points computed?

6. How many points can you get under the WAPS?

7. How are the APR points computed under the WAPS?

8. How many points are awarded for the Commendation Medal under the WAPS?

9. If you receive scores of 82 on your PFE and 78 on your SKT, how many WAPS points do these scores represent?

10. What three ranks are achieved under the WAPS?

4-5. Personnel Training

As a 91255, you will find increasing opportunities and responsibilities in the area of training 91235s and part-time clinic help. Since many optometry clinics are understaffed and may have 902XX or semipermanent help, it will be your responsibility to insure that this additional help is properly trained in job procedures.

020. List procedures and source material used to train optometry clinic personnel, and cite responsibilities of the trainer and the trainee.

Inducting the New Worker. Do you remember the first few weeks of your first assignment? It was probably a pretty hectic time. There may have been some confusion as to what you were to do, as well as who your contacts would be in the records section, registrar's office, supply section, etc. Nowadays, one way to reduce the time required to indoctrinate the new worker is to use a checklist similar to the one in figure 4-4.

Recognizing Training Needs. The first step in organizing training plan is to determine just what the trainee needs to know for a particular assignment. If you are training part-time personnel who will work in a specific area in the optometry clinic, you can tell which tasks that person will do by checking the appropriate working area task list (refer again to fig. 4-1. If you are training a 91235, you may use the 91235/55/75 Specialty Training Standard (STS) in the OJT folder.

Preparing Training References. There are several sources of training references. The 91235/55/75 STS lists civilian publications that will be helpful for upgrade training. The study guides and workbooks in 3ABR91235 are another excellent source of information. This CDC and the references in it will also help. Once you know which tasks the trainee will do, make an operational breakdown of each task, similar to the one in figure 4-5. Use of this breakdown will insure that you have not leftout any important steps.

If a job can be taught by proceeding from the easy steps to the difficult, teaching becomes easier. Few jobs, however, have their working sequence arranged in an order of increasing difficulty as shown at the top of figure 4-6. Instead, the difficult parts of the job are usually mixed in with the easy ones, like the second line on the figure. These steps have to be done on the job in the correct order, and therefore, they should be learned in that order. What can the supervisor-instructor do? He or she can keep the job in proper sequence and still teach the easier parts first by setting up a teaching plan as shown by the dark spots in each row of the chart. The instructor does the hard parts (white spots) while the worker does the easy parts (black spots), thus maintaining a learning sequence even in a difficult or long operation.

Duties of the Trainer and the Trainee. As a 91255 you will remain in a training status while you work for your 7 level. In addition, you may be helping 3 levels to achieve their 5 level, and in effect will be their trainer. Trainers should have the technical know-how as well as an attitude that enables them to get along with people. They are responsible to the supervisor. Trainers prepare work breakdowns for each airman. They instruct trainees on the equipment used in the clinic. They teach required theory and background information. They must motivate and evaluate their trainees. Not all of the training workload

WORKER'S NAME ______________________________ GRADE ______________

TITLE ______________________________ DATE HE REPORTS FOR WORK ______________

ORGANIZATIONAL UNIT ______________________________

Purpose: This list provides you with an outline to follow in welcoming and systematically inducting new workers. The induction period is your greatest opportunity to win the worker's loyalty, stimulate his interest, and get him into satisfactory production. Check each item to be sure you have welcomed the new worker properly and have given him all the information that he should have.

Date Completed

1. GET READY TO RECEIVE THE NEW WORKER
   - ( ) Review his work experience, education, and training.
   - ( ) Have an up-to-date description of his job or a list of his duties and responsibilities available for discussion with him.
   - ( ) Have his workplace, tools, equipment, and supplies ready.

2. WELCOME THE NEW WORKER
   - ( ) Put him at ease.
   - ( ) Indicate relationship to new worker.
   - ( ) Assign him a workplace, tools, equipment.

3. SHOW GENUINE INTEREST IN THE WORKER
   - ( ) Discuss his background and interests.
   - ( ) Inquire about his housing situation.
   - ( ) Inquire about his transportation to and from work.
   - ( ) Inquire about any possible financial difficulties because of the pay lag, and suggest local sources of assistance.

4. EXPLAIN THE WORK OF THE UNIT
   - ( ) Describe the function.
   - ( ) Outline the organization .
   - ( ) Indicate his position in the unit.
   - ( ) Explain relation of work to that of other workers.
   - ( ) Tell him to whom he reports and who reports to him.

5. INTRODUCE HIM TO THE CHIEF OF THE UNIT AND TO HIS COWORKERS
   - ( ) Indicate to each the new worker's duties.
   - ( ) Explain duties of each person to whom introduced.
   - ( ) Arrange for a coworker to go to lunch with him the first day.

6. SHOW HIM THE LAYOUT AND AVAILABLE FACILITIES
   - ( ) Explain layout of clinic.
   - ( ) Show him elevators, washroom, water fountain, and other facilities.

7. EXPLAIN RULES AND REGULATIONS
   - ( ) Hours of work.
   - ( ) Punctuality and good attendance.
   - ( ) Lunch period.
   - ( ) Rest periods.
   - ( ) Use of telephone.
   - ( ) Leave.
   - ( ) Other clinic practices and procedures (smoking, safety, wearing apparel, fire regulations).

8. INSTRUCT HIM IN HIS JOB OR ASSIGN HIM TO A QUALIFIED INSTRUCTOR
   - ( ) Give step-by-step instruction.
   - ( ) Explain quality and quantity work standards.
   - ( ) Assign him his workplace.
   - ( ) Indicate availability of instructor for future assistance.
   - ( ) Provide learning aids--samples of work, manuals, job instruction, procedures, list of special or technical terms.
   - ( ) Explain use and care of tools and equipment.
   - ( ) Stress safe working habits.
   - ( ) Stress security aspects of job.

9. FOLLOWUP
   - ( ) Check frequently on progress.
   - ( ) Encourage questions.
   - ( ) Make corrections and give encouragement.

Figure 4–4. Checklist for new workers.

TASK *Neutralize Lenses* OPERATION *Lensometry* No. ______

STEPS IN THE OPERATION Step: A logical segment of the operation in which something is done to advance the work.	KEY POINTS Key Points: Any directions or bits of information that help to perform the step correctly, safely, and easily.
Turn instrument ON.	1. Be sure instrument is plugged in.
Adjust eyepiece.	2. a. Place a piece of white paper in front of lensometer nose. b. Rotate eyepiece until circles are clear. c. Check adjustment by rotating power drum and noting position when mires are clear. Reading should be 0.00.
Insert lens.	3. a. Pull back on lensholder. b. Insert lens convex side toward you. c. Gently release lensholder.
Check for cylinder.	4. a. Rotate power drum until mires are nearly clear. b. Check for a break at the intersection of the mires. c. Rotate axis drum until lines are straight and continuous.

Figure 4-5. Task-operation breakdown.

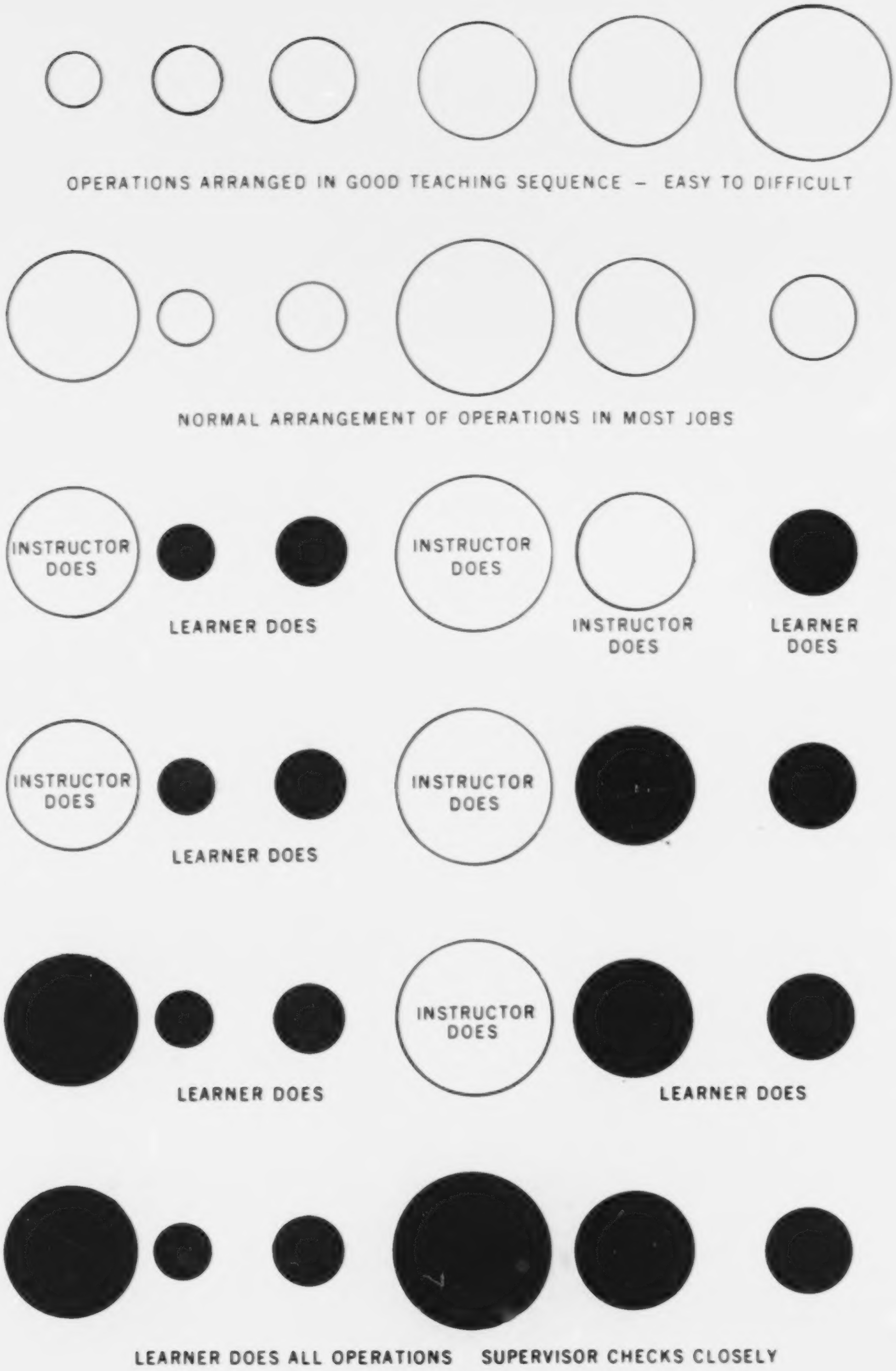

OPERATIONS ARRANGED IN GOOD TEACHING SEQUENCE – EASY TO DIFFICULT
NORMAL ARRANGEMENT OF OPERATIONS IN MOST JOBS
INSTRUCTOR DOES
LEARNER DOES
INSTRUCTOR DOES
INSTRUCTOR DOES
LEARNER DOES
INSTRUCTOR DOES
LEARNER DOES
INSTRUCTOR DOES
LEARNER DOES
INSTRUCTOR DOES
LEARNER DOES
LEARNER DOES ALL OPERATIONS
SUPERVISOR CHECKS CLOSELY

Figure 4–6. How to teach the difficult task.

falls on the trainers. The trainees must also do their part. The trainees must know where to locate and how to read their job descriptions, training requirements and objectives, and their training folder. They must accept and react favorably to motivational efforts of the trainers and supervisors. They must budget their time so that study assignments will be completed within the time limit. They must maintain their training materials in good condition.

Exercises (020):

1. List nine steps you should follow in "breaking in" a new worker.

2. Name two sources of training materials that are readily available to you.

3. List four duties and responsibilities of a trainer.

4. List four duties and responsibilities of a trainee.

CHAPTER 5

Administrative Record Keeping

SOME PESSIMIST once said that if we could eliminate all the paperwork from military activities, we could save enough woodpulp to reforest the Nation. As an example, for every printed page of this CDC, about 24 pages of originals and copies of handwritten and typed manuscript pages, authorizations, and coordinations were necessary. The ratio is a little better in the hospital: 5 copies are made of physical examinations, 3 copies of spectacle order forms, and only one (original) of the SF 600. Since paper processing is necessary to our system, this chapter is designed to familiarize you with the necessary "whys" and "hows".

5-1. Publications

Every large organization must have some way to communicate its policy and guidelines from the managers to the workers. Verbal communication may be the quickest, but most people like to see important news "on paper" to avoid the possibility of misinterpretation. The Air Force communicates important news and policies via written documents called *publications*. Since some of those publications affect your duties in the optometry clinic, you must be able to find and use pertinent publications to maintain uniformity of service and standardization of procedures.

021. List the types and classes of AF publications, interpret the AF publications numbering system, and state how we request publications.

Air Force Publications. Air Force publications are the media through which the Secretary of the Air Force, the Chief of Staff of the Air Force, and various echelon commanders announce policies, prescribe procedures, and furnish instructions and information necessary to the Air Force mission. Air Force commanders and staff officials at all organizational levels need to communicate written policies, procedures, and information to personnel under their jurisdiction. A publication is the most reliable, effective, and economical way to communicate information that is going to affect many people or organizations. Another advantage of the publication is that it can be kept conveniently available for future reference. Air Force publications are divided into two general classes, departmental and field. Departmental publications are issued by, or for, HQ USAF and one or more major air commands or by HQ USAF alone. An example of a departmental publication would be AFR 168–4, *Administration of Medical Activities*. Field publications originate at major air command level or below and are used only within the issuing activity. An example of a field publication would be TACM 168–4. The standard publications you will use most are regulations, manuals, and pamphlets. These may be issued at either departmental or field level. Although there are other types of publications, for now you need concern yourself only with these three.

Regulations. Regulations are used to announce policies, assign responsibilities, direct actions, and prescribe procedures. Regulations are usually considered permanent directives. If a regulation has an expiration date less than 18 months after date of issuance, it is considered temporary.

Manuals. Manuals contain permanent and detailed instructions, procedures, and techniques telling personnel how to do their jobs. The manual may be a compilation of material related to an entire function or it may be a step-by-step directive telling how to do a specific task or operation. For example, if you need a publication to explain step by step how to prepare an outstanding performance report on one of your workers, you could find this information in AFR 39–62, *Noncommissioned Officer and Airman Performance Reports*. Training manuals that are primarily informational or instructional will be issued as pamphlets as they are revised, and the Air Force is currently in the process of changing directive AFMs to AFRs.

Pamphlets. Pamphlets are handbooks, booklets, or brochures containing informative and instructional rather than directive material. They are usually issued as brochures and may be written in an informal style to create and maintain reader interest. They are permanent in nature, but may contain an expiration date.

Locating Publications Using AFR 0–2, *Numerical Index of* Standard and Recurring Air Force Publications." Of the many departmental indexes of publications, AFR 0–2 gives the most information about each publication and will be your most frequently used index. AFR 0–2 gives an alphabetical listing of the basic subject series and a numerical listing of each publication subject and title. The numerical listing is arranged by publications series number. For example, all publications dealing with medical administration are numbered 168 and are referred to as the 168-series. Other medical series are shown in table 5-1.

In addition to the series number, each publication has a control number, preceded by a dash (example, 168–1, 168–2, etc.). Control numbers are normally assigned in sequence beginning with a number "1" for each series. Figure 5-1 illustrates the numbering system. From the number we can tell that AFR 5–4 is a departmental

TABLE 5–1

USAF MEDICAL PUBLICATIONS SERIES NUMBERS

SERIES NO.	NAME
160-	Medical Service
161-	Aerospace Medicine
162-	Dental Services
163-	Veterinary Service
164-	Aeromedical Evacuation
167-	Medical Materiel
168-	Medical Administration
169-	Medical Education and Research

publication (because of the "AF" in AFR) and a regulation (because of the "R"). We couldn't tell that this copy is obsolete, though, unless we checked the publication date in a current AFR 0–2. If our example had been TACR 5–4, we would know that this is a field publication. To find out its title we would have to check TAC Regulation 0–2, which is the Numerical Index for Tactical Air Command publications. Because one publication cannot duplicate information contained in another publication, TACR 5–4 would not be the same as AFR 5–4 and could even apply to a completely different area than AFR 5–4. However, if TAC would like to clarify or add to AFR 5–4, it could issue a supplement to this publication. Supplements to regulations are always issued at a lower command level than the one that published the original. They are called *changes* when they are issued at the same level of command that issued the original.

As an example of how to use AFR 0–2 to find a publication, let us suppose that you are due for a promotion in the near future and you want to look up the directive that covers promotions. You would first look in AFR 0–2, page 2. In this alphabetical listing, the general heading "Enlisted Personnel" is your best bet to find promotions. "Enlisted Personnel" is the heading for the 39-series. You would then turn to the 39-series in the 0–2 and find "*Promotion of Airmen*" and its publication date listed opposite "R 39–29". This means that information on airman promotion can be found in AFR 39–29. To be sure the information is current, you should write down the publication date to compare with the date of the regulation itself. While you're at it, check the date of the index. AFR 0–2 should never be more than about six months old.

You know what publications are and how they are numbered and listed in AFR 0–2, now how do you get them?

Requesting Air Force Publications. The hospital administrator is responsible for supervising all official publications used in your medical facility. Each section in the hospital must establish its publications requirements with the administrative office (usually the hospital Sgt Major). You, as a supervisor wanting a publication, must send a memo to the Sgt Major listing the publication number, title, justification, and number of copies required. The Sgt Major will review the list for essentiality and then consolidate the requirements from all sections. Finally, the Sgt Major orders each basic publication (including its changes to date) and prepares a separate request to have your hospital included on the series distribution list at the Publications Distribution Office. This assures that you will be included when new changes to your publications come out.

Requesting Civilian Publications. When you need civilian publications—for example, the ANSI Z 80.1 standards booklet or a visual science dictionary—there are two ways to get them. If your hospital has a medical library, you should submit a request to the librarian. Although the exact format of your request may vary

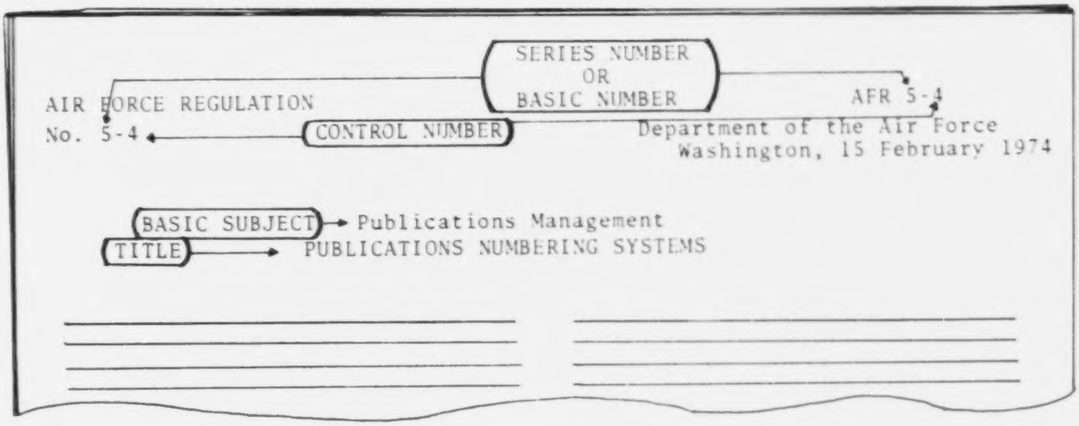


Figure 5–1. The USAF Publications Numbering System.

according to local policy, generally the librarian will need the stock number (if applicable), title, edition, author, publisher, unit cost, number required, and justification (in narrative form—short paragraphs. If your hospital does not have a library, order civilian publications through medical supply. Check your local policy for the exact procedure.

Exercises (021):

1. What are Air Force publications?

2. What are the two classes of AF publications?

3. What are the three main types of AF publications, and what changes are now in progress?

4. What publication contains an index of AF publications?

5. How do you order AF publications?

6. Whom do you see to order civilian publications?

5-2. Files and Records

Just how do you keep track of all of the forms, records, letters, regulations, order blanks, catalogs, logbooks, etc. used in your clinic? Do you simply dump everything in your bottom-left desk drawer and wade through a bunch of loose papers every time you have to look up something, or do you maintain an orderly filing system which can be understood and used by everybody in the clinic? The Air Force has some suggestions for maintaining an orderly documentation system, and the essence of these suggestions is printed here.

022. State what directives control the contents of the clinic's documentation filing system, and cite general guidelines for organizing the files.

Categories of Documentation. The AF categorizes documentation as official, private, or personal. All documentation (as defined in *AFR 12-1, Air Force Documentation Management Program)*, and any copies made by an Air Force activity are official documentation. Organized collections of official documentation are official files. Official files that are used frequently in conducting current business are maintained in the custody of offices responsible for that function. These offices are known as *offices of record* according to AFM 12–20, *Maintenance of Current Documentation*, which also gives policies, procedures and techniques for maintaining documentation files.

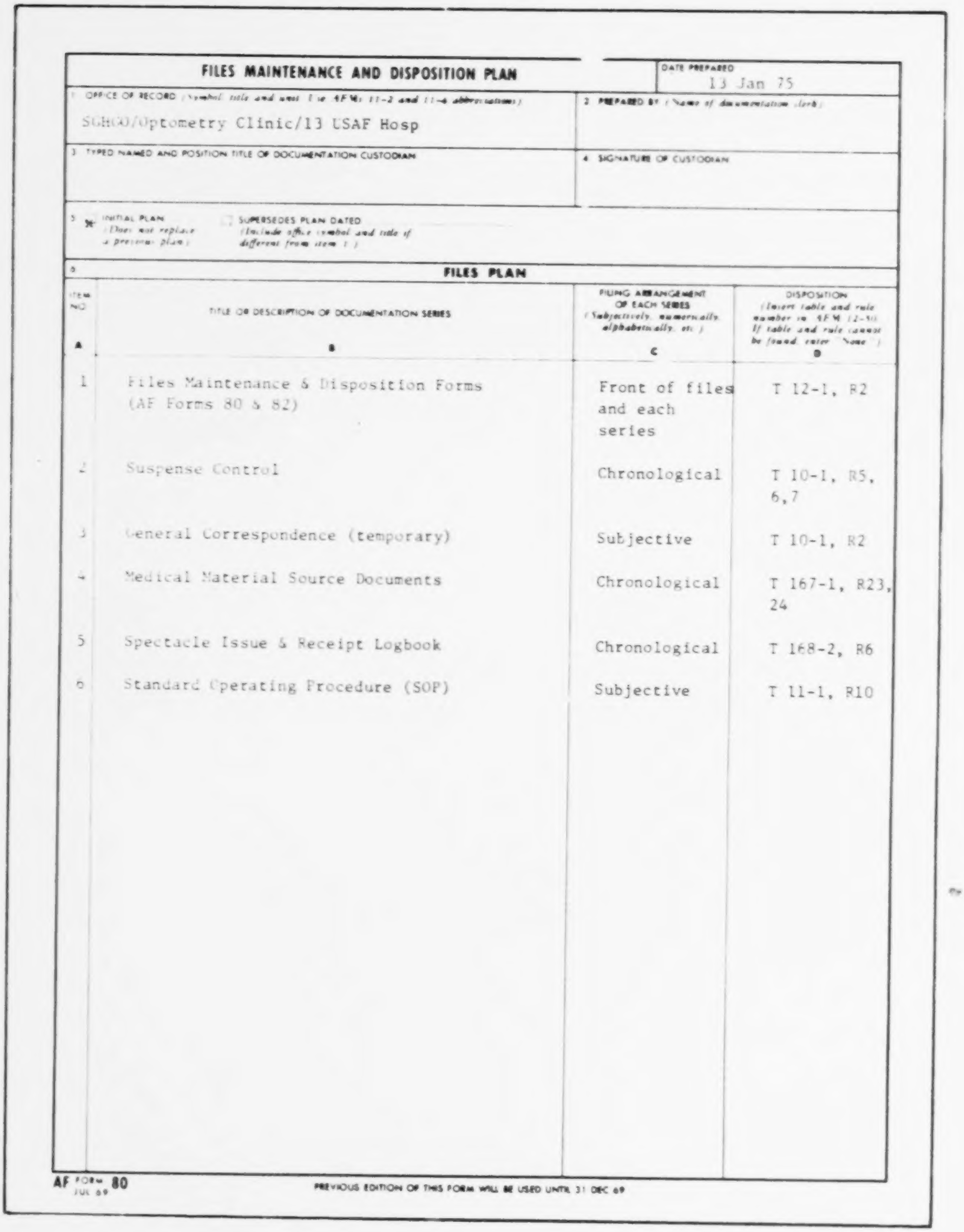
Disposition Policies. AFM 12–50, *Disposition of Air Force Documentation*, Chapter 4, outlines the disposition policies and procedures for AF documentation. No AF documentation may be destroyed unless it is authorized in the disposition standards in AFM 12–50.

Optometry Clinic Files. Official documentation held by the optometry clinic as the office of record, might include,

a. General correspondence.
b. Reading file.
c. Office projects and studies.
d. Requests for blank forms.
e. Copies of visual tests.
f. Literature on visual standards.
g. Environmental survey reports.
h. Medical material source documents.
i. Medical material inventories.
j. Using activity property records.
k. Medical equipment maintenance records.
l. Custodian account files.
m. Medical services staffing reports.
n. Spectacle issue and receipt records.
o. Clinical records.
p. Health records.
q. Report of patients.
r. Minutes of safety council meetings.
s. Standard operating procedures (SOPs).
t. General reference publications.
u. Official visits/staff visits.

If your clinic keeps copies of any of this material, you must include in the file an AF Form 80, Files Maintenance and Disposition Plan, and an AF Form 82, Files Disposition Control Label, to identify the documentation and to prescribe its retirement or destruction. The AF Form 80 (fig. 5-2) must identify all documentation for which your office is responsible. Make at least two copies of AF Form 80, as directed in local supplements to AFM 12–20. As the office of record, you keep the original in front of the current files, and send the duplicate to the documentation manager. You should review and amend AF Form 80 periodically to insure that all files and documents are accounted for, and that cited disposition authorities are appropriate. Notify the documentation manager of any changes. Use the same form for changes; just delete noncurrent information, and enter new information.

After you have prepared AF Form 80, prepare an AF Form 82 (fig. 5-3), for each subitem with a different retention period. AF Form 82 is printed on a paper stock with an adhesive back. Affix the AF Form 82 to the tabs of the guide cards in front of each documentation series or in a conspicuous spot on the container. If there are several containers, AF Form 82 may be affixed to the first container or to each container.



FILES MAINTENANCE AND DISPOSITION PLAN

DATE PREPARED: 13 Jan 75

1. OFFICE OF RECORD (Symbol, title and unit. Use AFMs 11-2 and 11-4 abbreviations): SGHCO/Optometry Clinic/13 USAF Hosp

2. PREPARED BY (Name of documentation clerk):

3. TYPED NAMED AND POSITION TITLE OF DOCUMENTATION CUSTODIAN:

4. SIGNATURE OF CUSTODIAN:

5. ☒ INITIAL PLAN (Does not replace a previous plan) ☐ SUPERSEDES PLAN DATED (Include office symbol and title if different from item 1.)

6. **FILES PLAN**

ITEM NO A	TITLE OR DESCRIPTION OF DOCUMENTATION SERIES B	FILING ARRANGEMENT OF EACH SERIES (Subjectively, numerically, alphabetically, etc.) C	DISPOSITION (Insert table and rule number in AFM 12-50. If table and rule cannot be found, enter "None".) D
1	Files Maintenance & Disposition Forms (AF Forms 80 & 82)	Front of files and each series	T 12-1, R2
2	Suspense Control	Chronological	T 10-1, R5, 6,7
3	General Correspondence (temporary)	Subjective	T 10-1, R2
4	Medical Material Source Documents	Chronological	T 167-1, R23, 24
5	Spectacle Issue & Receipt Logbook	Chronological	T 168-2, R6
6	Standard Operating Procedure (SOP)	Subjective	T 11-1, R10

AF FORM 80 JUL 69 PREVIOUS EDITION OF THIS FORM WILL BE USED UNTIL 31 DEC 69

Figure 5-2. AF Form 80.

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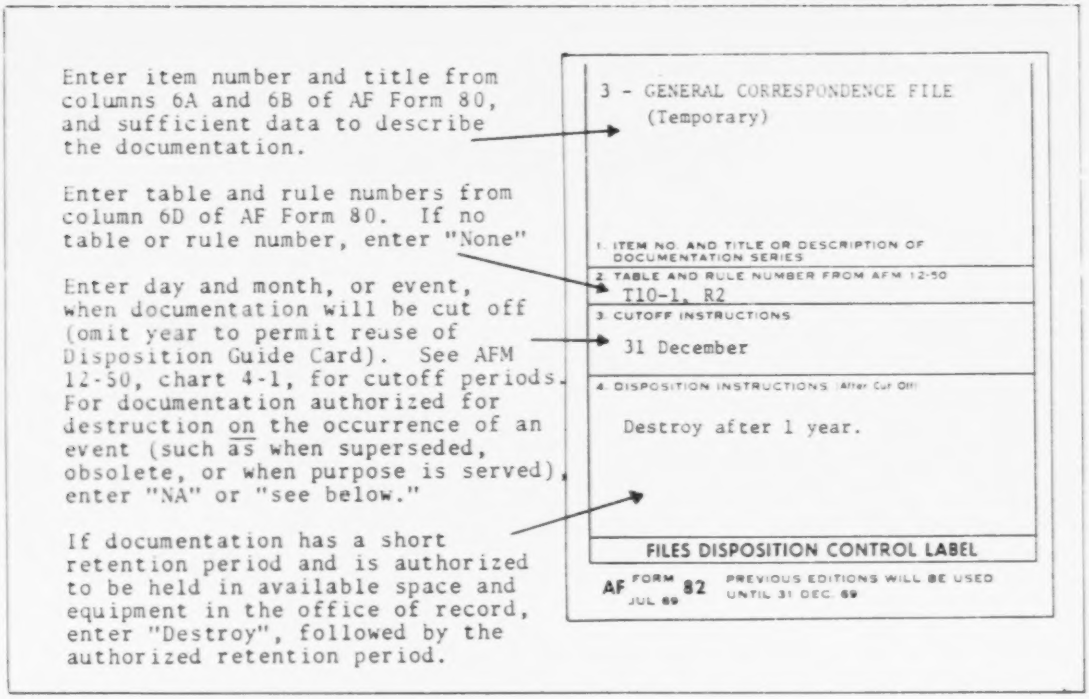


Enter item number and title from columns 6A and 6B of AF Form 80, and sufficient data to describe the documentation.

Enter table and rule numbers from column 6D of AF Form 80. If no table or rule number, enter "None"

Enter day and month, or event, when documentation will be cut off (omit year to permit reuse of Disposition Guide Card). See AFM 12-50, chart 4-1, for cutoff periods. For documentation authorized for destruction on the occurrence of an event (such as when superseded, obsolete, or when purpose is served), enter "NA" or "see below."

If documentation has a short retention period and is authorized to be held in available space and equipment in the office of record, enter "Destroy", followed by the authorized retention period.

3 - GENERAL CORRESPONDENCE FILE
(Temporary)

1. ITEM NO. AND TITLE OR DESCRIPTION OF DOCUMENTATION SERIES

2. TABLE AND RULE NUMBER FROM AFM 12-50
T10-1, R2

3. CUTOFF INSTRUCTIONS
31 December

4. DISPOSITION INSTRUCTIONS (After Cut Off)
Destroy after 1 year.

FILES DISPOSITION CONTROL LABEL

AF FORM JUL 69 82 PREVIOUS EDITIONS WILL BE USED UNTIL 31 DEC. 69

Figure 5-3. AF Form 82, Files Disposition Control Label.

Appendix C of this volume gives basic disposition information for files. AFM 12-20, Chart 4-2, lists the types of filing equipment authorized for storing official documentation. (Basically, you can use a letter-size file cabinet or a file box, but not your desk unless the volume of files is small.)

Exercises (022):

1. What basic directive is concerned with policies, procedures, and techniques for maintaining current documentation?

2. What directive gives disposition policies and procedures for AF documentation?

3. Comparing the list of optometry clinic documentation in the text with the data in Appendix C, which items would you be most likely to find in an optometry clinic file in an average optometry clinic?

4. What form must be completed showing all of the official documentation held in your clinic?

5. What form must be affixed to each folder or container of official documentation?

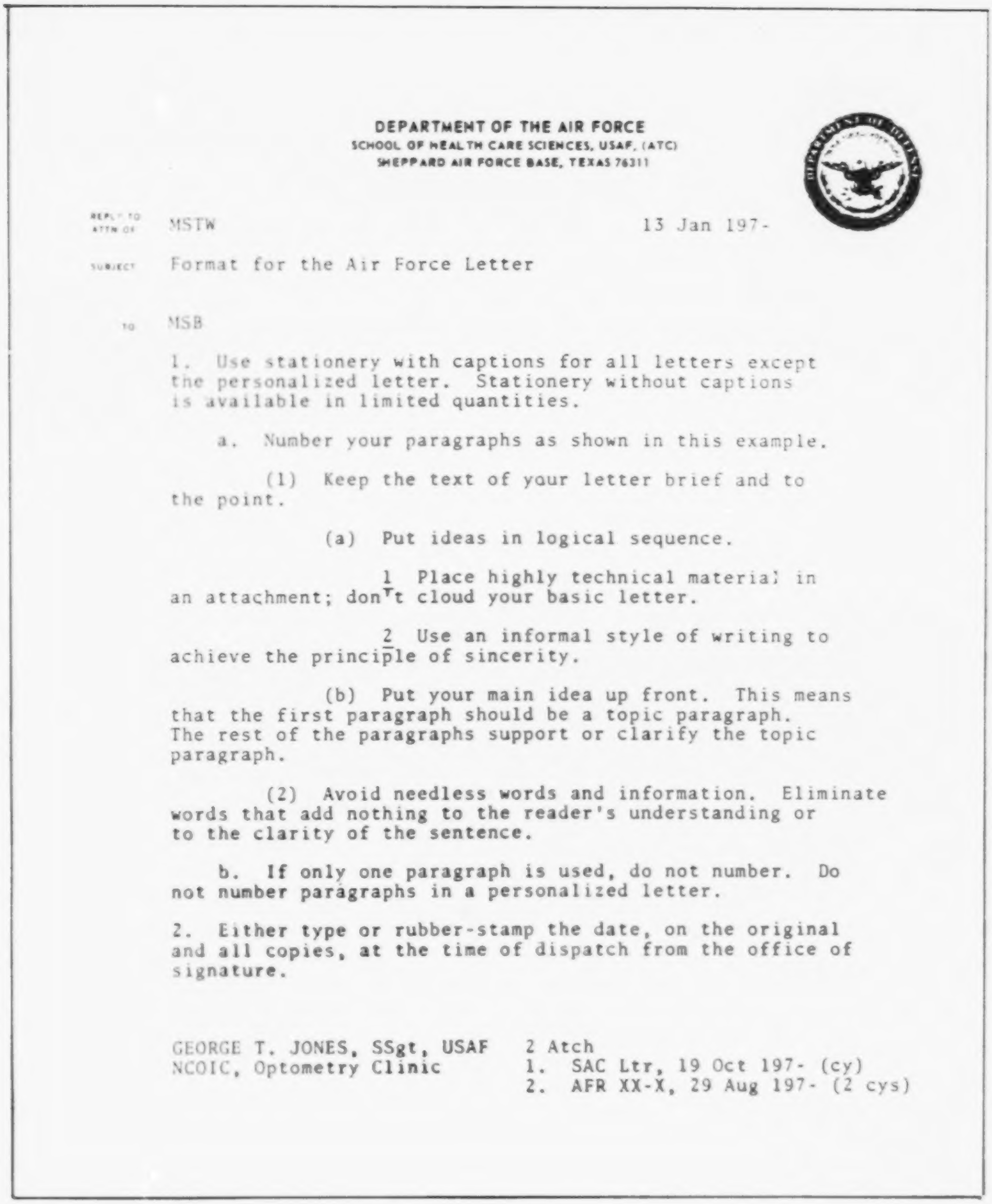
5-3. Correspondence

I know that you believe you understand what you think I wrote, but I am not sure you realize that what you read is not what I meant!

How many times have you read a message that made about as much sense as that one? Are you guilty of writing letters that are redundant and filled with technical jargon? The primary purpose of correspondence, whether it is a message to the lab or a letter to a civilian counterpart, is communication, and, in order to communicate effectively, you must know the basic principles of writing.

023. State basic principles and proper format for effective letters and messages.

Letter Format and Style. Read the letter in figure 5-4. It effectively and briefly indicates the *what, where, when,*



DEPARTMENT OF THE AIR FORCE
SCHOOL OF HEALTH CARE SCIENCES, USAF, (ATC)
SHEPPARD AIR FORCE BASE, TEXAS 76311

REPLY TO ATTN OF: MSTW 13 Jan 197-

SUBJECT: Format for the Air Force Letter

TO: MSB

1. Use stationery with captions for all letters except the personalized letter. Stationery without captions is available in limited quantities.

a. Number your paragraphs as shown in this example.

(1) Keep the text of your letter brief and to the point.

(a) Put ideas in logical sequence.

1 Place highly technical material in an attachment; don't cloud your basic letter.

2 Use an informal style of writing to achieve the principle of sincerity.

(b) Put your main idea up front. This means that the first paragraph should be a topic paragraph. The rest of the paragraphs support or clarify the topic paragraph.

(2) Avoid needless words and information. Eliminate words that add nothing to the reader's understanding or to the clarity of the sentence.

b. If only one paragraph is used, do not number. Do not number paragraphs in a personalized letter.

2. Either type or rubber-stamp the date, on the original and all copies, at the time of dispatch from the office of signature.

GEORGE T. JONES, SSgt, USAF
NCOIC, Optometry Clinic

2 Atch
1. SAC Ltr, 19 Oct 197- (cy)
2. AFR XX-X, 29 Aug 197- (2 cys)

Figure 5–4. Sample AF letter.

who, why, and *how* of a communication. The captions show where it came from, to whom to reply, what it is about, for whom it is intended, and the date it was sent. The body of the letter shows the *why* and *how* of the message. Every well-written letter has four characteristics—*shortness, simplicity, strength*, and *sincerity*. In addition, the material should be current and complete.

Shortness. The length of a letter will vary according to many factors. Ask yourself if your letter says more than need be said, or uses too many words to say what it must. Watch out for the fault of over-condensing your letter, however, because you may not get your thoughts across. A few hints on shortness would include putting your main idea first (topic paragraph), avoiding needless words and information, avoiding unnecessary prepositional phrases, and avoiding use of irrelevant "ifs."

Simplicity. Basically, this means you should know your subject and not try to give the reader a snow job. Use short words, sentences, and paragraphs. Connect your sentences with a transitional device to provide an even flow of your reader's thought stream.

Strength. Don't use abstract nouns. Use concrete, specific words. Don't generalize; your letter should be aimed at a single person or a single problem. Use active verbs—your sentences will be stronger. Don't take forever to get to the point; give your answer immediately, then explain if necessary. Don't hedge; the reader can spot a copout in a letter easier than in a speech.

Sincerity. Write to the individual in a personal manner. Too much impersonality makes a letter (and its writer) sound inhuman. If you goofed, admit your mistake in plain language and show how you will correct the error. Don't try to snow the reader with superlatives, and don't let your letters sound arrogant or subservient; the reader may have enough trouble believing what you say, even without these distractors.

The words you use in your communication will vary, depending on the reader. If you are writing a technical letter to another paraoptometric, you should use professional terminology; but if your reader is a patient or a nonprofessional, you should use nontechnical language to get your point across. In either case, use the *correct* terminology. If you aren't sure about a word, look it up in a medical dictionary.

Exercises (023):

1. Name four characteristics of a well-written letter.

2. What do the captions in an AF letter show?

3. What statement best describes the selection of terminology level to be used in a letter?

5-4. Self-Inspection

The word "inspection" always seems to cause apprehension and heartburn. If you have been in the Air Force for any length of time, you are familiar with the "scurrying about" that takes place a few days before an inspection team is due on base, and you have probably heard the comment, "If I just had the inspectors' checklist . . ." Well, why make your own checklist?

024. Develop a self-inspection checklist for your clinic.

Inspectors develop their checklists from the same directives you use each day in your clinic. You know all the important facets of your job, so you have the capability to anticipate and develop a checklist equal to that of an inspection team. Let's review some of the items you may want to include in your checklist.

Previous Inspection Reports. A good starting point is a review of previous inspection reports. These reports will provide an overview of the factors inspection teams considered important in the past. They will also point out previous discrepancies. Here lies your key to passing inspections. Many times inspectors check to see if discrepancies noted on previous inspections have been corrected. Repeat writeups are an absolute no-no. Correct the discrepancies and include these areas as important items on your list. If you don't, you can anticipate some indepth poking and prodding from the next inspector who enters your clinic.

Governing Directives. Now that you have a list of discrepancies and items of special interest from previous inspections, the next step is to review all regulations and directives that control your clinic operations. Be sure to include clinic SOPs in your review. They identify prominent areas of responsibility within your clinic.

Patient Backlog. Many factors influence the backlog of patients awaiting treatment in your clinic. As a minimum, you should know whether a substantial backlog exists and, if so, what is being done to reduce it. You may have a large backlog but not enough personnel, equipment and facilities, or time to do anything about it. If so, document these facts—this shows an inspector that you are at least aware of the backlog.

Clinic Manning. Evaluate your authorizations and note any existing shortages. Also document your daily activities as specified in Chapter 3. If you spend your entire day ordering and dispensing spectacles and answering the telephone, you certainly don't have time to help reduce a patient backlog.

Screening Program. Most inspection teams place much emphasis on screening programs. If you have a screening program, review it and insure that the program is managed properly. If you don't have one, be prepared to explain why. Some typical reasons are clinic manning, equipment, facilities, and problems; the age of the patient population; and the distance patients must travel. You must look at your situation objectively and document your reasons for not screening patients; otherwise, you can expect a writeup.

Appointments. Survey your appointment system to check its effectiveness. You may want to consider how far ahead appointments are booked, how many patients are appointed that should not be appointed, when logs are open for appointments, and whether the patient can expect to get an appointment within a reasonable time. Document your findings. Appendix D shows you a sample of the checklist an inspector might use. Your checklist should at least cover the items in this appendix. Once you develop a checklist, use it on a continuing basis. Do this and the next inspector will have to look elsewhere for discrepancies.

Exercises (024):

1. Review the information in this section and in Appendix D. Then develop a self-inspection checklist for your clinic.

CHAPTER 6

Equipment and Supplies

THE OPTOMETRY clinic, as does any other hospital section, needs certain equipment and supplies to maintain its operations. Many specialists gripe and moan about the supply system when, in fact, it may be their own fault that the supplies have not arrived. This chapter will expand your knowledge of medical material procedures so that you can order items correctly for your clinic.

6-1. Custodian Account Responsibilities

A custodian account number is assigned to each using section by the medical material section. Each custodian account is the responsibility of a property custodian in the using activity.

025. State who is responsible for property, custodial assignments, and for the Report of Survey.

Functions of the Property Custodian. A property custodian is an officer, a warrant officer, an NCO, airman or a civilian employee who is responsible for all property issued to or in possession of a unit, clinic, section, or department of a hospital. Normally, the property custodian of the Optometry Clinic is the NCOIC (noncommissioned officer in charge).

The property custodian is appointed by the director of base medical services, placed on orders, and assigned an account symbol to indicate the location of all equipment. The property custodian is held directly responsible for all equipment listed on the inventory, even though it is everyone's responsibility to safeguard Government property.

Since we are all subject to frequent changes of position and location, it is often necessary to transfer equipment from one property custodian to another to keep account of all equipment. A property custodian, who is going to be away from the property 45 days or more, must have a complete inventory of the property and transfer responsibility to another custodian. If you are the losing property custodian, you must prepare a letter to the DBMS requesting the transfer. The DBMS will then appoint a new custodian, one you've probably recommended. After the transfer is approved, you and the new custodian will make an inventory of all listed equipment. Each will sign a certificate of transfer certifying all equipment listed on the inventory sheet is present and accounted for. Don't take the inventory lightly.

Report of Survey. The property custodian is normally responsible for ordering and safekeeping material. If any Government property valued in excess of $500 is lost or damaged, a Report of Survey must be initiated unless the person admits responsibility. The survey will be initiated if the responsible individual doesn't admit pecuniary liability. The Report of Survey system is an investigation into the circumstances relating to the loss, damage, or destruction of Government property. It is conducted by a disinterested officer or warrant officer. An NCO in the grade of E–7, E–8, E–9, or a civilian of equivalent rank may be appointed when there is insufficient officer strength available for a surveying officer. The report of survey provides a complete and impartial investigation of the loss by a disinterested officer called the surveying officer. When pecuniary charges are recommended, the person to be charged must examine the surveying officer's report and may make a written statement in defense. It may be a review of the report of survey by a higher echelon of command, depending on the value of the loss. It is a method of appeal for those who feel they have been charged unjustly.

Exercises (025):

1. Match the items in column A with the correct answers in column B. Each answer may be used once, more than once, or not at all.

Column A	*Column B*
______(1) Usual property custodian in the optometry clinic.	a. Director of base medical services.
______(2) Appoints property custodians for optometry clinic.	b. AF Form 601b.
______(3) Method used to transfer equipment to another custodian.	c. Letter to DBMS.
______(4) Report of survey investigator.	d. NCOIC of the clinic.
	e. Surveying officer.
	f. OIC of the clinic.

6-2. Ordering Equipment and Supplies

Since you will probably be assigned the duty of property custodian, you should know how to order and account for all supplies and equipment used in your clinic.

026. Cite general supply classification and identification procedures that relate to the optometry clinic.

Item Classification and Identification. In the Federal Supply System, items are classified by the Federal Supply Classification (FSC), which is the first 4 digits of the stock number. Each class of items has a general category name and number; for example, Pharmacy (6505), Surgical

Dressings (6510), Medical-Surgical Instruments, Equipment, and Supplies (6515), Opticians' Instruments, Equipment, and Supplies (6540), etc.

Identification lists (IL). Identification lists are published or grouped according to the FSC number; for example, Identification List, FSC 6540, Opticians' Instruments, Equipment, and Supplies. These identification indices identify items by name, picture, and an accompanying description along with the national stock number. Each identification list has an alphabetical index and a stock number index, which may be used for cross-referencing items.

The alphabetical index. Figure 6-1 lists items names, synonyms, colloquials, common names, and trademark names, along with index numbers to locate the items within a subsection. Item names appear in uppercase letters; other names appear in uppercase and lowercase letters. The alphabetical index in FSC Class 6505 contains only approved item names referenced to their applicable index numbers; colloquials, synonyms, and trademark names are referenced to their appropriate approved item names in the "Glossary of Colloquial Names and Therapeutic Index, "C-6505-GL."

National Stock Number Index. This index lists national stock numbers (NSNs) in numerical sequence, with index numbers to locate the items within a subsection (fig. 6-2). Items that have been deleted since the dates of the superseded publication are marked "Deleted" in the "Index No." column.

Identification data. The following data are arranged alphabetically by the item name under which the item is identified in the Federal Cataloging System (fig. 6-3). Each item or a representative item is illustrated when such presentation is necessary for identification.

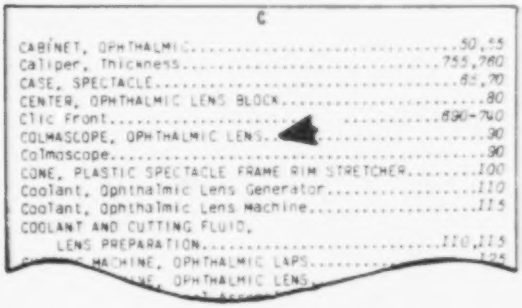
(1) Action code—denotes an addition, deletion, or revision of published data, as follows:

a. N (New)—indicates an item not previously included in the basic publication, change bulletin, or change notice, or a reinstatement of an item previously deleted from a basic publication, change bulletin, or change notice.

b. C (Change)—indicates a change in data since the previous publication.

c. D (Deletion)—indicates that an item has been deleted.

(2) Index numbers—items are presented in alphabetical order; index numbers are assigned in ascending sequence within each pamphlet. The index numbers are used solely as a locator device and are NOT to be used in lieu of the national stock number or to requisition materiel. Upon revision of a catalog subsection, the index numbers are revised to conform with the sequence of items.



C

CABINET, OPHTHALMIC..............................50,55
Caliper, Thickness..............................755,760
CASE, SPECTACLE..............................65,70
CENTER, OPHTHALMIC LENS BLOCK..............................80
Clic Front..............................690-740
COLMASCOPE, OPHTHALMIC LENS..............................90
Colmoscope..............................90
CONE, PLASTIC SPECTACLE FRAME RIM STRETCHER..............................100
Coolant, Ophthalmic Lens Generator..............................110
Coolant, Ophthalmic Lens Machine..............................115
COOLANT AND CUTTING FLUID,
LENS PREPARATION..............................110,115
MACHINE, OPHTHALMIC LAPS..............................
OPHTHALMIC LENS,

Figure 6–1. Sample NSN Alphabetical Index.

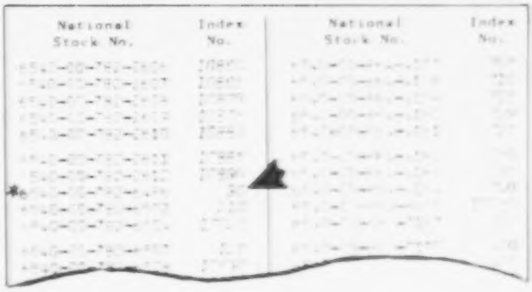

National Stock No.
Index No.
National Stock No.
Index No.

Figure 6–2. Sample National Stock Number Index.

(3) National Stock Number—the 11-digit Federal Stock Number has been changed to the 13-digit national stock number in medical catalogs published since October 1972. Two digits have been added to denote the NATO code number. The first four digits comprise the FSC, and the last nine digits comprise the National Item Identification Number (NIIN), which uniquely identifies the item (see fig. 6-4). The 13-digit NSN is used to order items as of September 1981. An item is identified by its name and number, but procurement requests for items under $100 contain only the number of the item.

(4) Descriptive data—Important distinguishing characteristics are stated in the Descriptive Data column.

(5) Description—Appears below the item name and above the box in which the Index No., NSN, and

COLMASCOPE, OPHTHALMIC LENS

15 watts. For detecting lens strains caused by mounting or heat treating. For replacement lamp, order §6240-00-143-3061.

Action	Index No.	National Stock No.	Descriptive Data
C	90	6540-00-782-6486	115 volt, 60 Hz, AC

§Item not managed by DPSC. Obtain in accordance with appropriate Military Service Management Data Lists.

Figure 6–3. Sample identification list entry.

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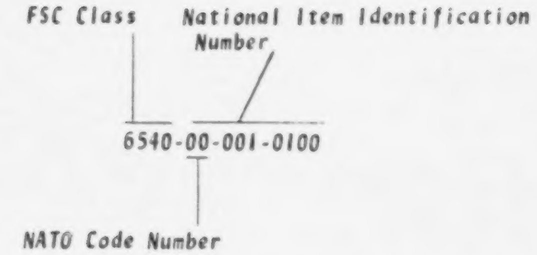


Figure 6–4. The National Stock Number (NSN).

Descriptive Data are arranged, or may be arranged in an additional column to the right of the Descriptive Data column. Operational information may appear as a footnote below the boxed data.

(6) Information regarding special storage and handling of an item appears under "Notes." The symbols used are shown in table 6-1.

Management List (ML). The management list index (see fig. 6-5) lists supply management data by NSN. This supply management data includes:

a. An action code, identifying an action not previously published. These codes are shown in table 6-2.

b. An acquisition advice code, indicating how an item will be acquired in the Defense Medical Supply System. Table 6-3 shows the acquisition advice codes, together with their meanings.

c. Price.

d. Unit of issue—for example, pair, each, roll, set.

e. Packaging and packing information, including intermediate package quantity and exterior container quantity.

f. Weight and cubage.

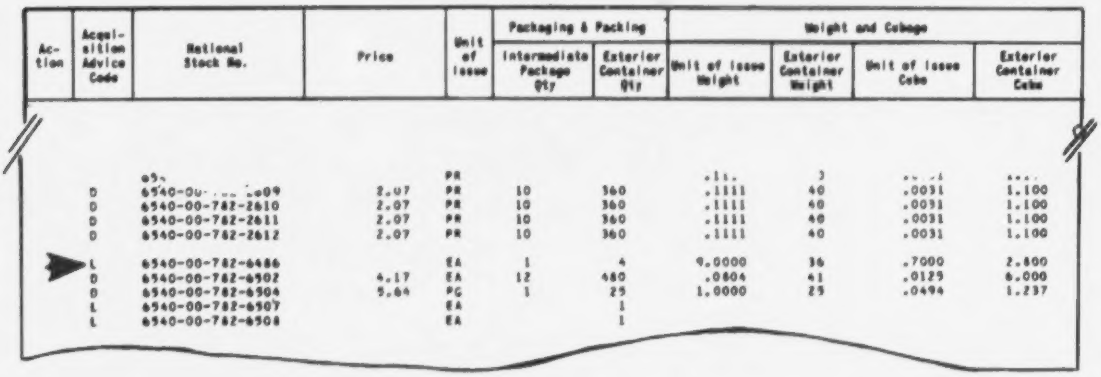
When your requirements approximate the intermediate package or exterior container quantities, requisition these quantities, since this eliminates the need to repackage for shipping.

TABLE 6–1

NATIONAL SUPPLY SYSTEM NOTES

Symbol	Explanation
D	Subject to deterioration in a period of 36 months or less.
F	Subject to damage by freezing.
G	Requires refrigeration between 2°C and 8°C (35°F to 46°F).
I	Flammable or oxidizing.
K	An item which is a drug, or other substance determined by the Director, Bureau of Narcotics and Dangerous Drugs, Department of Justice, to be designated Schedule Symbol III, IV, or V, as defined in the Controlled Substances Act, effective 1 May 1971, and other items requiring security storage.
P	Item with potency period or expiration date.
R	Alcohol, alcoholic beverages, precious metals, or a drug or other substance determined by the Director, Bureau of Narcotics and Dangerous Drugs, Department of Justice, to be designated Schedule Symbol II, as defined in the Controlled Substances Act, effective 1 May 1971, and other items requiring vault storage.
W	Must be frozen for preservation.

Federal Supply Catalogs. The identification list and the management list are published separately, but used together they may be considered as a Federal Supply Catalog. For optometry technicians, the two most commonly used Federal Supply Catalogs are: C-6540-IL and ML, Opticians' Instruments, Equipment, and Supplies; and C-6515-IL and ML, Medical and Surgical Equipment and Supplies.



Action	Acquisition Advice Code	National Stock No.	Price	Unit of Issue	Packaging & Packing: Intermediate Package Qty	Packaging & Packing: Exterior Container Qty	Weight and Cubage: Unit of Issue Weight	Weight and Cubage: Exterior Container Weight	Weight and Cubage: Unit of Issue Cube	Weight and Cubage: Exterior Container Cube
		65[illegible]		PR			.11[illegible]	[illegible]	[illegible]	[illegible]
	D	6540-0[illegible]09	2.07	PR	10	360	.1111	40	.0031	1.100
	D	6540-00-782-2610	2.07	PR	10	360	.1111	40	.0031	1.100
	D	6540-00-782-2611	2.07	PR	10	360	.1111	40	.0031	1.100
	D	6540-00-782-2612	2.07	PR	10	360	.1111	40	.0031	1.100
	L	6540-00-782-6486		EA	1	4	9.0000	36	.7000	2.800
	D	6540-00-782-6502	4.17	EA	12	480	.0804	41	.0129	6.000
	D	6540-00-782-6504	5.64	PG	1	25	1.0000	25	.0494	1.237
	L	6540-00-782-6507		EA		1				
	L	6540-00-782-6508		EA		1				

Figure 6–5. Sample management data list entries.

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TABLE 6–2
NSN ACTION CODES

Code	*Action*
C	Indicates a change in data other than the National Stock Number and is identified by an asterisk to the right of the data changed.
D	Indicates a National Stock Number has been deleted and not replaced.
N	Indicates a National Stock Number not previously included in the basic publication or change bulletin, or reinstatement of a National Stock Number.
R	Indicates that a National Stock Number has been deleted and replaced, or changed.

Another Federal Supply Catalog frequently used is the General Services Administration (GSA) catalog. The GSA Catalog contains information on many office and expendable supplies used throughout the Federal Government. These three catalogs may be researched for specific items of equipment or supplies required in the optometry clinic.

Civilian supply catalogs. If you can't find a specific item in one of the Federal Supply Catalogs, you may have to use a civilian catalog. Don't order items from civilian catalogs if you can get a satisfactory item through the Federal Supply System. Items ordered through a civilian catalog are often more expensive than those ordered via the Federal Supply System.

Expendable and Accountable. Everything you order for your clinic falls into one or the other categories.

Expendable or supply items. These are items that meet any *one* of the following criteria:

a. Are consumed during use.
b. Have less than 5 years life expectancy.
c. Cost less than $300.

Accountable or equipment items. These are items that must be assigned to a property custodian. In general, they must meet all *three* of the following criteria:

a. Retain their identity during use.
b. Have greater than 5 years life expectancy.
c. Cost more than $300.

There are two categories of accountable items:

a. *Expense*. Items costing $300.00 to $2,999.99 and fitting the above criteria.

b. *Investment*. Items costing over $3,000, and fitting the other criteria.

TABLE 6–3
NSN ACQUISITION ADVICE CODES

Code	*Acquisition Advice*
A	Service regulated item. The use and storage of this item requires release authority from the appropriate medical service. Requisitions will be submitted in accordance with the military services' requisitioning procedures.
D	Item centrally managed, stocked and issued under control of one Inventory Control Point (ICP) for all customers.
H	Item centrally procured but not stocked. Issue is by direct shipment from the vendor to the user at the order of the ICP. (Except where a military service directs otherwise, MILSTRIP requisitions will be submitted directly to the Directorate of Medical Materiel, Defense Personnel Support Center, 2800 South 20th Street, Philadelphia PA 19101. Requisitions should provide for sufficient procurement lead time [at least 90 days after receipt of requisitions at DPSC].)
L	Item authorized for local purchase, as a normal means of support, at base, post, camp, or station level. Item not stocked in domestic depot system. Appeal to ICP, or to prescribed purchasing activity, when unable or not permitted to procure locally.
V	Item in stock; but future procurement is not authorized. Requisitions may continue to be submitted until stocks are exhausted.
W	Restricted requisitioning. Stock number has been assigned for use in bid invitations. Requisitions will not be submitted to DPSC until otherwise advised by the military services.
X	Semiactive item; item not authorized for stockage at wholesale level.

Exercises (026):

1. What two ILs are most often used in the optometry clinic?

2. If you know the trade name of a medical item, but not its approved item name, what publication will give you the correct approved item name?

3. What does the Identification List action code "D" mean?

4. Where and on what form do you write the index number when ordering equipment?

5. What do the acquisition advice codes "D" and "L" mean?

Which of these items are expendable, and which are nonexpendable?

6. Items that cost over $300.

7. Items that are consumed during use.

8. Items that last less than 5 years.

027. State which forms to use for specified requisitions.

Procedures for Initiating Requests. The procedures for ordering materiel differ slightly according to the type of materiel under consideration, its cost, and local practices. A *standard* item is one that is listed in Federal Supply Catalogs. Normally no justification is required and medical items are ordered on DD Form 1348–6, Non-NSN Requisition (fig. 6-6), and nonmedical items are ordered on AF Form 2005, Issue/Turn-In Request (fig. 6-7). Since the criteria for filling out these forms will vary due to local policy, get your instructions from your local supply unit. A justification is always required for items over $300, and these items are ordered on AF Form 601b, Custodian Request/Receipt. A blank form and instructions are shown in figure 6-8A and figure 6-8B, respectively.

Nonstandard items are those NOT found in Federal Supply Catalogs, and must be locally purchased. Depending upon local policy, a justification may or may not be required. In either case, you order nonstandard items less than $300 on DD Form 1348–6, Non-NSN Requisition. This includes nonstocklisted replacement parts for stocklisted equipment; such as AC Adapter for opthalmoscope handles, and Burton lamp bulbs. You order nonstandard items over $300, and nonstandard replacement parts for nonstandard equipment on AF Form 601b, Custodian Request/Receipt. You may also have to submit a DD Form 1348–6.

Exercises (027):

Which forms are normally used to order the following items?

1. Standard items under $300.

2. Standard items over $300.

3. Nonstandard items under $300.

4. Nonstandard items over $300.

5. Nonstocklisted replacement parts for stocklisted equipment.

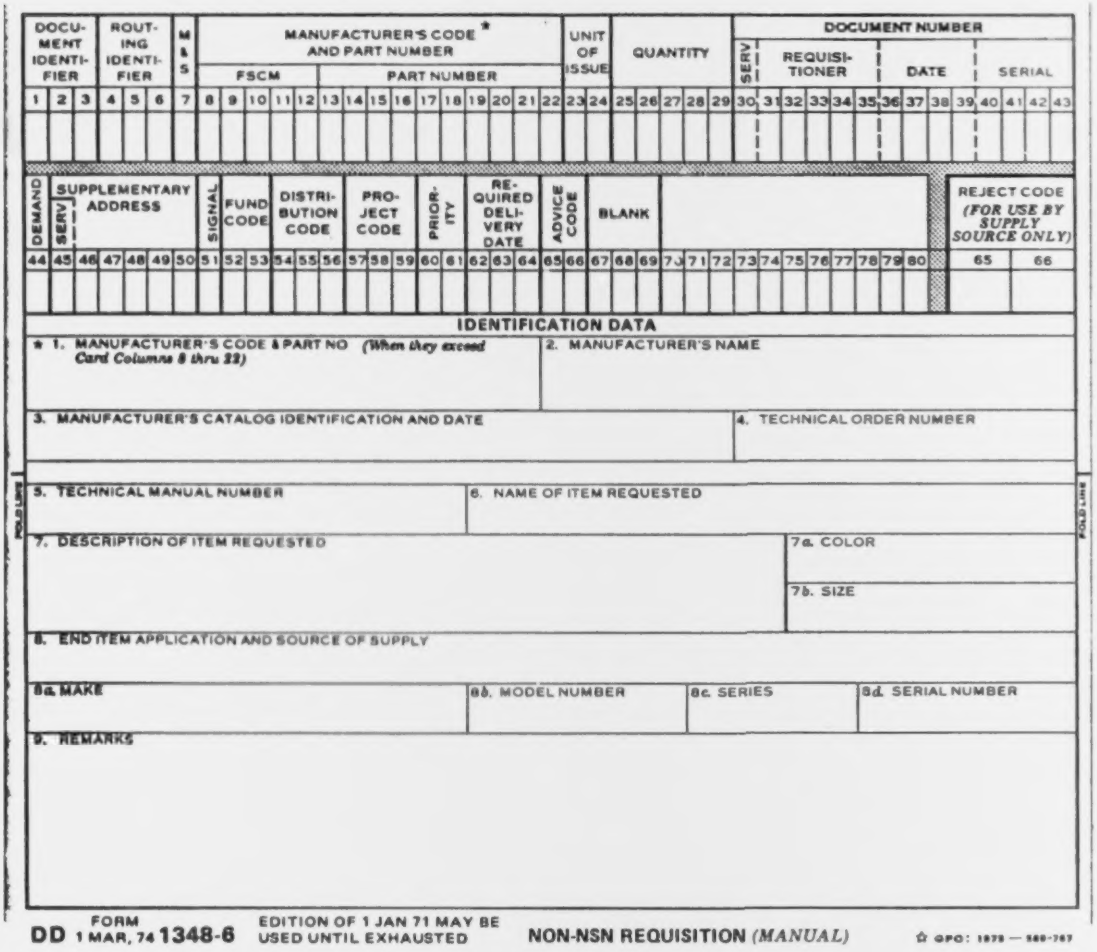
6. Nonstocklisted replacement parts for nonstocklisted equipment.

6-3. Equipment Maintenance

In addition to ordering eye clinic equipment, you should be reasonably familiar with the construction and operation of such equipment so you can make minor repairs on the spot without causing delays in patient treatment.

028. List procedures for effective preventive maintenance on optometry clinic equipment.

Equipment Maintenance Responsibilities. It is the primary responsibility of the medical equipment repair section (MER) to repair any broken optometry clinic equipment; however, many repairs are of a very simple type that you can do in the clinic. Preventive maintenance should be done on all instruments and equipment to reduce the downtime and inconvenience to both the clinic and the patient.



DOCUMENT IDENTIFIER	ROUTING IDENTIFIER	M & S	MANUFACTURER'S CODE * AND PART NUMBER: FSCM	PART NUMBER	UNIT OF ISSUE	QUANTITY	DOCUMENT NUMBER: SERV	REQUISITIONER	DATE	SERIAL
1 2 3	4 5 6	7	8 9 10 11 12	13 14 15 16 17 18 19 20 21 22	23 24	25 26 27 28 29	30	31 32 33 34 35	36 37 38 39	40 41 42 43

DEMAND	SUPPLEMENTARY ADDRESS: SERV		SIGNAL	FUND CODE	DISTRIBUTION CODE	PROJECT CODE	PRIORITY	REQUIRED DELIVERY DATE	ADVICE CODE	BLANK		REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY)	
44	45	46 47 48 49 50	51	52 53	54 55 56	57 58 59	60 61	62 63 64	65 66	67 68 69	70 71 72 73 74 75 76 77 78 79 80	65	66

IDENTIFICATION DATA

★ 1. MANUFACTURER'S CODE & PART NO *(When they exceed Card Columns 8 thru 22)*

2. MANUFACTURER'S NAME

3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE

4. TECHNICAL ORDER NUMBER

5. TECHNICAL MANUAL NUMBER

6. NAME OF ITEM REQUESTED

7. DESCRIPTION OF ITEM REQUESTED

7a. COLOR

7b. SIZE

8. END ITEM APPLICATION AND SOURCE OF SUPPLY

8a. MAKE

8b. MODEL NUMBER

8c. SERIES

8d. SERIAL NUMBER

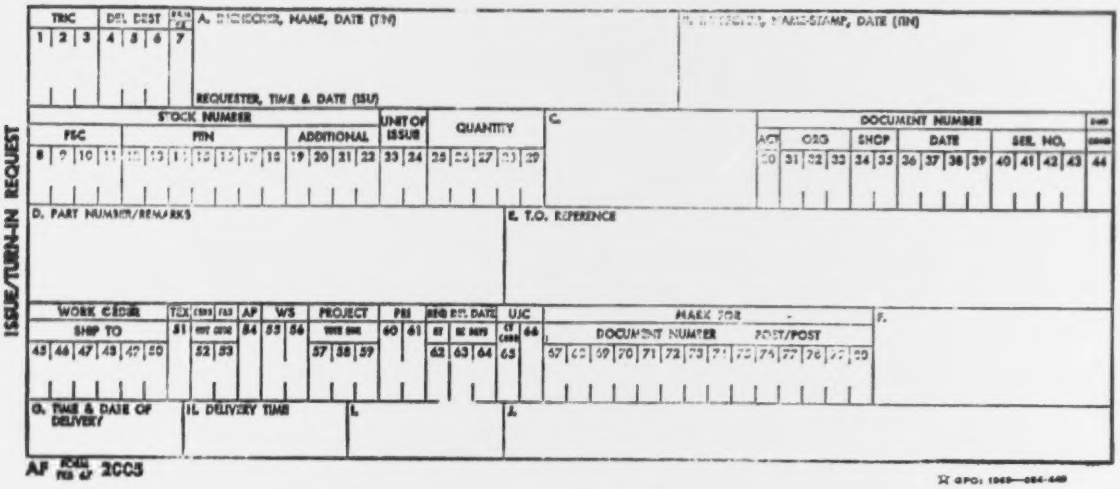
9. REMARKS

FOLD LINE

FOLD LINE

DD FORM 1 MAR. 74 1348-6 EDITION OF 1 JAN 71 MAY BE USED UNTIL EXHAUSTED NON-NSN REQUISITION *(MANUAL)* ☆ GPO: 1975 — 586-767

Figure 6–6. Sample DD Form 1348–6.



ISSUE/TURN-IN REQUEST

TRIC	DEL DEST	[illegible]	
1 2 3	4 5 6	7	

A. [illegible], NAME, DATE (TIN)

REQUESTER, TIME & DATE (ISU)

B. [illegible], NAME-STAMP, DATE (TIN)

STOCK NUMBER: FSC	FIIN	ADDITIONAL	UNIT OF ISSUE	QUANTITY	C.	DOCUMENT NUMBER: ACT	ORG	SHOP	DATE	SER. NO.	[illegible]
8 9 10 11	12 13 14 15 16 17 18	19 20 21 22	23 24	25 26 27 28 29		30	31 32 33	34 35	36 37 38 39	40 41 42 43	44

D. PART NUMBER/REMARKS

E. T.O. REFERENCE

WORK ORDER / SHIP TO	TEX	[illegible]	AP	WS	PROJECT	PRI	REQ DEL DATE	UJC	MARK FOR: DOCUMENT NUMBER	POST/POST	F.
45 46 47 48 49 50	51	52 53	54	55 56	57 58 59	60 61	62 63 64	65 66	67 68 69 70 71 72 73 74	75 76 77 78 79 80	

G. TIME & DATE OF DELIVERY

H. DELIVERY TIME

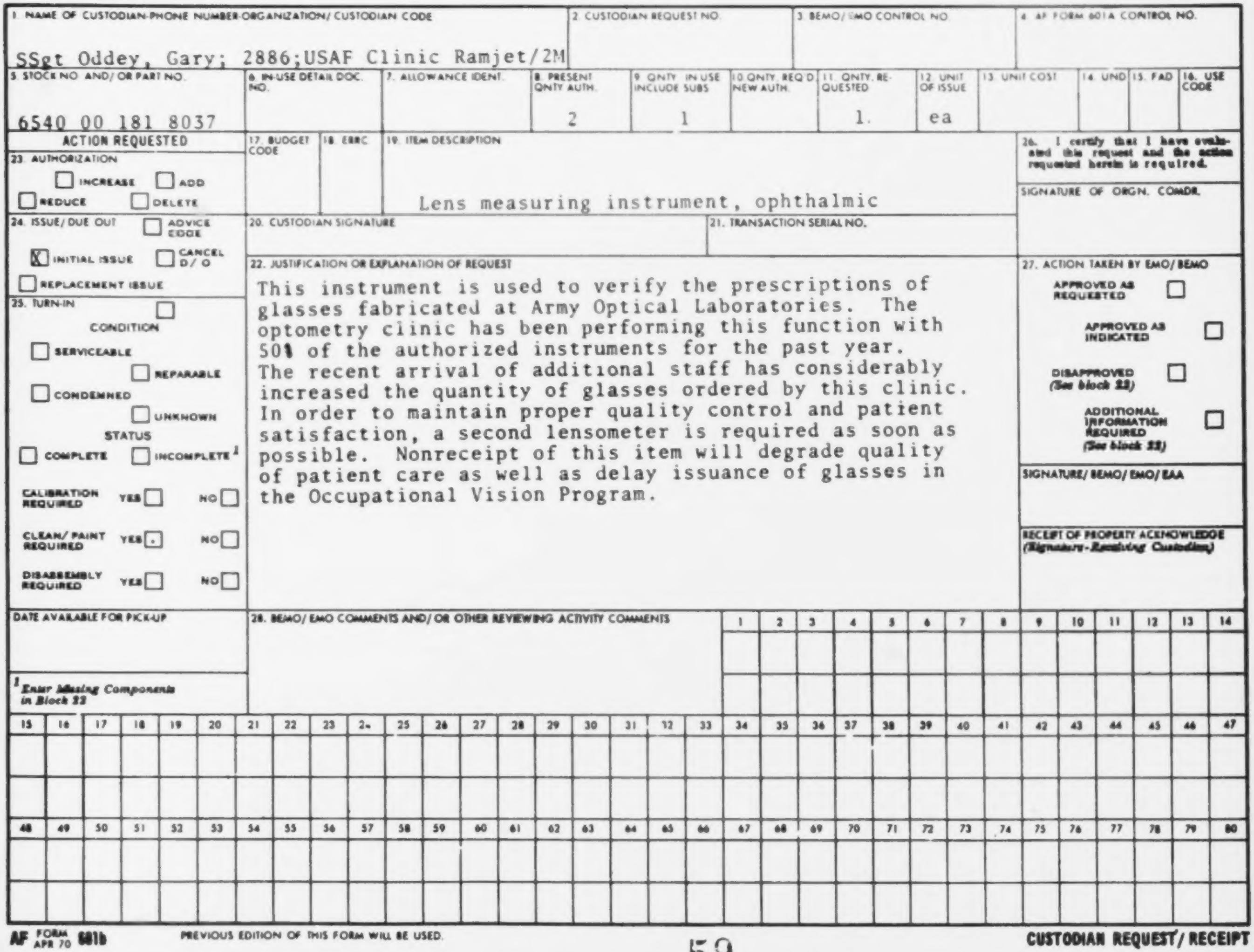
I.

J.

AF FORM FEB 67 2005 ☆ GPO: 1969—084-449

Figure 6–7. Sample AF Form 2005.

BEST COPY AVAILABLE



1. NAME OF CUSTODIAN-PHONE NUMBER-ORGANIZATION/ CUSTODIAN CODE
SSgt Oddey, Gary; 2886;USAF Clinic Ramjet/2M

2. CUSTODIAN REQUEST NO.

3. BEMO/ EMO CONTROL NO.

4. AF FORM 601A CONTROL NO.

5. STOCK NO. AND/ OR PART NO.
6540 00 181 8037

6. IN-USE DETAIL DOC. NO.

7. ALLOWANCE IDENT.

8. PRESENT QNTY AUTH.
2

9. QNTY IN USE INCLUDE SUBS
1

10. QNTY REQ'D. NEW AUTH.

11. QNTY. REQUESTED
1.

12. UNIT OF ISSUE
ea

13. UNIT COST

14. UND

15. FAD

16. USE CODE

ACTION REQUESTED

23. AUTHORIZATION
☐ INCREASE ☐ ADD
☐ REDUCE ☐ DELETE

24. ISSUE/ DUE OUT ☐ ADVICE CODE
☒ INITIAL ISSUE ☐ CANCEL D/ O
☐ REPLACEMENT ISSUE

25. TURN-IN ☐
CONDITION
☐ SERVICEABLE
☐ REPARABLE
☐ CONDEMNED
☐ UNKNOWN
STATUS
☐ COMPLETE ☐ INCOMPLETE[1]
CALIBRATION REQUIRED YES ☐ NO ☐
CLEAN/ PAINT REQUIRED YES ☐ NO ☐
DISASSEMBLY REQUIRED YES ☐ NO ☐

17. BUDGET CODE

18. ERRC

19. ITEM DESCRIPTION
Lens measuring instrument, ophthalmic

20. CUSTODIAN SIGNATURE

21. TRANSACTION SERIAL NO.

22. JUSTIFICATION OR EXPLANATION OF REQUEST
This instrument is used to verify the prescriptions of glasses fabricated at Army Optical Laboratories. The optometry clinic has been performing this function with 50% of the authorized instruments for the past year. The recent arrival of additional staff has considerably increased the quantity of glasses ordered by this clinic. In order to maintain proper quality control and patient satisfaction, a second lensometer is required as soon as possible. Nonreceipt of this item will degrade quality of patient care as well as delay issuance of glasses in the Occupational Vision Program.

26. I certify that I have evaluated this request and the action requested herein is required.

SIGNATURE OF ORGN. COMDR.

27. ACTION TAKEN BY EMO/ BEMO
APPROVED AS REQUESTED ☐
APPROVED AS INDICATED ☐
DISAPPROVED *(See block 22)* ☐
ADDITIONAL INFORMATION REQUIRED *(See block 22)* ☐

SIGNATURE/ BEMO/ EMO/ EAA

RECEIPT OF PROPERTY ACKNOWLEDGE *(Signature-Receiving Custodian)*

DATE AVAILABLE FOR PICK-UP

[1] *Enter Missing Components in Block 22*

28. BEMO/ EMO COMMENTS AND/ OR OTHER REVIEWING ACTIVITY COMMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

AF FORM APR 70 601b PREVIOUS EDITION OF THIS FORM WILL BE USED. CUSTODIAN REQUEST/ RECEIPT

Figure 6–8A. Sample AF Form 601b.

BLOCK	*TITLE*	*ENTRY*
1	Name of custodian-phone number-organization/custodian code.	Self-explanatory.
2	Custodian request number.	Enter request number from Form 115a if this form is required by your major command.
3	BEMO/EMO control number.	Leave blank.
4	AF Form 601a control number.	Leave blank.
5	Stock number and/or part number.	Enter National Stock Number, if any.
6	In-use detail document number.	Leave blank.
7	Allowance identification.	Enter TA number - if item is local purchaseor not authorized, enter "041."
8	Present quantity authorized.	Self-explanatory.
9	Present quantity in-use including subs.	Enter number of items presently in use.
10	Quantity required new authorization.	Enter number if authorization increase is being requested.
11	Quantity requested.	Enter number of items needed.
12	Unit of issue.	Enter appropriate purchasing unit (ea, etc).
13	Unit cost.	Leave blank.
14	Fund code.	Leave blank.
15	Force Activity Designator.	Leave blank.
16	Use code.	Leave blank.
17	Budget code.	Leave blank.
18	ERRC.	Leave blank.
19	Item description.	Enter detailed description.
20	Custodian signature.	Custodian should sign here.
21	Transaction serial number.	Leave blank.
22	Justification or explanation of request.	Give facts which support a need for the item requested.
23	Authorization.	Indicate if this item is an addition to authorization/reduction of number on hand, or a deletion of the item.
24	Issue/due out.	Indicate whether item replaces an existing piece of equipment, or is a new item.
25	Turn in.	Check appropriate blank if item is for turn-in.
26	Signature of organization commander.	Leave blank.
27	Action taken by EMO/BEMO.	Leave blank.
28	BEMO/EMO comments and/or other reviewing activity comments.	Leave blank.

Figure 6–8B. Sample AF Form 601b, Instructions.

Preventive Maintenance Procedures. Each piece of equipment or optometric instrument comes packed with a spare parts manual and a repair diagram. If the item of equipment is stocklisted, the repair part must also be stocked in the Federal Supply System. Good housekeeping methods keep your equipment operating longer and help your clinic look cleaner. Dust and grime on the gears and shafts of delicate optometry clinic equipment cause this equipment to jam or act in an erratic manner. Corrosion of the fine threads in focus adjustment eyepieces can cause calibration errors in lensometers, keratometers, and other devices. A fine coating of oily grime can coat the optics of opthalmoscopes, retinoscopes, and phoropter lenses. Poor lubrication of perimeters and other devices can cause noisy and erratic operation.

Proper handling of equipment while you are moving it can reduce the incidence of miscalibration due to excessive vibration or collision with another object. Most optometric equipment calibration adjustment controls are locked in place with tiny screws. Loss of these screws can lead to great calibration errors. Now let's finish this volume with a few tips on keeping optometry clinic equipment and instruments in good shape.

Phoropter unit. Periodically clean the exterior of the phoropter with alcohol. Polish the exterior lenses and prisms with a clean nonabrasive cloth. Clean the retinoscopy lenses with a Q-tip and alcohol. Occasional cleaning of both surfaces of the interior lenses can be done with Q-tips, tampons, and alcohol. Don't leave smears on the lenses, and don't let the alcohol drip into the gear mechanism. Keep the lenses covered when they aren't in use.

Chair. Keep exterior clean with a good detergent. Check power cord for cracked or frayed areas. Periodically lubricate moving parts.

Slit lamp. Keep exterior clean with detergent. Clean chin and headrests with alcohol. Keep optics clean with Q-tips and alcohol. Do not disturb the small thumbscrews at the base of the light unit; they control the position and focus of the filament image.

Ophthalmoscope/Retinoscope. Keep the optics clean with alcohol and Q-tips. Make sure the electrical contacts are clean and tight.

AO Non-Contact Tonometer. Dust easy-to-get-to areas with a clean nonabrasive cloth. Clean chin and forehead rests with alcohol sponges. Clean the sensory light and sensory receptors with alcohol and Q-tips. Wipe eyepiece with soft nonabrasive cloth.

Most eye clinic equipment is sturdily built, but a little negligence may lead to disaster. Preventive maintenance and simple repairs done by you may save significant time and money, but don't try to fix something that is beyond your capabilities. Paying for a piece of equipment that you broke may leave you broke.

Exercises (028):

1. Who is supposed to fix broken equipment?

2. Where can you find the replacement part number for a broken piece of stocklisted equipment?

3. What is the best single preventive maintenance measure in the average clinic?

Bibliography

ECI Courses

CDC 90250, Volume 1, *The Medical Airman*. Extension Course Institute, Gunter Air Force Station, Alabama.

CDC 90650, Volume 3, *Administrative Control of Patients and Beds* (Part I). Extension Course Institute, Gunter Air Force Station, Alabama.

Department of the Air Force Publications

AFR 0–2, *Numerical Index of Standard and Recurring Air Force Periodicals*.
AFR 5–1, *Air Force Publications Management Program*.
AFR 5–4, *Publications Numbering Systems*.
AFR 12–1, *Air Force Documentation Management Program*.
AFM 12–20, *Maintenance of Current Documentation*.
AFM 12–50, *Disposition of Air Force Documentation*.
AFP 13–2, *Guide for Air Force Writing*.
AFM 26–3, *Air Force Manpower Standards*, Volume 4.
AFR 30–30, *Standards of Conduct*.
AFR 39–1, *Airman Classification Regulation*.
AFR 39–29, *Promotion of Airmen*.
AFR 39–62, *Noncommissioned Officer and Airman Performance Reports*.
AFR 168–4, *Administration of Medical Activities*.
AFR 168–6, *Persons Authorized Medical Care*.
AFR 168–9, *Uniform Services Health Benefits Program*.
AFR 168–10, *Medical, Dental, and Veterinary Care from Civilian Sources*.
AFM 168–695, *MAMS—Medical Administrative Management System*.
AFR 211–16, *Personal Commercial Affairs*.

NOTE: None of the items listed in the bibliography above are available through ECI. If you cannot borrow them from local sources, such as your base library or local library, you may request one item at a time on a loan basis from the the AU Library, Maxwell AFB AL 36112, ATTN: ECI Bibliographic Assistant. However, the AU Library generally lends only *books* and a limited number of *AFMS*. *TOs*, classified publications, and other types of publications are *not* available. Refer to current indexes for the latest revisions of and changes to the official publications listed in the bibliography.

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APPENDIXES

Appendix A. General Information on Civilian Paraoptometric Personnel Training.
Appendix B. Sample Standard Operating Procedure (SOP).
Appendix C. Files Disposition Plan.
Appendix D. Sample Self-Inspection Checklist.

Item	*Class of Patient*	*Authorized Spectacles*	*Additional Data*
1	Air Force Officers, Warrant Officers, Enlisted, and AF Academy Cadets.	Yes.	
2	Army Officers, Warrant Officers, Enlisted, and USMA Cadets.	Yes.	
3	Navy and Marine Corps Officers, Warrant Officers, Enlisted, and Midshipmen of US Naval Academy.	Yes.	
4	Coast Guard Officers, Warrant Officers, Enlisted, and Coast Guard Academy Cadets.	Yes.	
5	US Public Health Service Commissioned Corps of USPHS and National Oceanic Atmosphere Administration.	Yes.	See item 17.
6	Uniformed Services Reserve and National Guard Personnel on Active Duty, Active or Inactive Duty for Training Officers, Warrant Officers, and Enlisted.	These personnel authorized free refraction and aircrew spectacles (only). Authorization extends only to those individuals actively performing duty that involves flying, air traffic controlling, parasail instructing or weather observing (see AFR 167-3, para 11).	
7	Retired Members All AF, Army, Navy, Marine Corps, Coast Guard, Commissioned USPHS, National Oceanic Atmosphere Administration.	Yes.	
8	VA Beneficiaries.	Only at AF hospitals which have beds authorized for VA.	Charge.
9	Soldiers' and Airmen's Home Members.	No.	
10	ROTC, JROTC, CAP, Scouts.	No.	See item 15.
11	Applicants for enlistment or commission.	No.	
12	POWs and others in military custody or confinement.	Yes.	
13	Military prisoners (punitive discharge executed) hospitalized beyond expiration of sentence.	No.	
14	Nonmilitary Federal prisoners.	No.	
15	US Govt. employees who are injured during their employment, or ROTC and CAP personnel requiring care beyond their specified assignment.	Yes, with prior authorization only.	Charge.
16	Crew members of vessels of National Oceanic Atmosphere Administration; USCG Auxiliary; Seamen on ships of US Registry, inside or outside CONUS; Seamen on state school ships; Cadets at state maritime academies on state training ships; Seamen on Mississippi River Commission vessels; and officers and crews of Fish - Wildlife Service; members of Merchant Marine Cadet Corps; Employees and Noncommissioned Officers of USPHS Field Service; Civilian Seamen in service of ships operated by Army and Military Sealift Command within or without the US and its possessions; American Indians in CONUS; American Indians, Eskimos, and Aleuts in Alaska.	No.	

Item	*Class of Patient*	*Authorized Spectacles*	*Additional Data*
17	USPH Reserve Commissioned Officers in inactive status.	No.	
18	US Citizen officers, employees, and authrized dependents of State Dept., USIA US AID, Foreign Agriculture Service, FAA, Bureau of Public Roads, US Geological Survey, VA, and Peace Corps staff members and volunteers.	Spectacles are authorized only outside CONUS at individual's expense, and only when not available through commercial sources.	Charge.
19	FBI, Secret Service, US Marshalls in Alaska, claimants administered by the Dept. of Justice.	No.	
20	Job Corps or VISTA personnel.	No.	
21	US citizen employees of DOD and other Govt. agencies outside US and their dependents.	Yes, only when not available through commercial sources. Examination included.	Charge.
22	Non-US citizen employees of DOD and their dependents when civilian facilities not available.	No.	
23	Civilian employees covered by Federal Civilian Employees' Health Program.	No.	
24	Social Security Beneficiaries.	No.	
25	American Red Cross inside or outside CONUS.	No.	
26	Welfare workers.	No.	
27	US citizen scientific consultants, technician representatives, contract technicians and their dependents.	Yes, outside CONUS only and only when not available through commercial sources and only when authorized.	Charge.
28	Alien scientific and technological specialists, employees of commercial airlines, civilian employees of contractors (outside CONUS), US citizens who assist the oversea commander in mission accomplishment.	No.	
29	News representatives, representatives of commercial airlines and oil companies, etc.	No.	
30	Professional educators, USO executives, directors and dependents, civilian religious leaders, entertainers, etc.	No.	
31	Civilians training in AF facilities performing aircrew duties.	No.	
32	Army and AF Exchange Service personnel proceeding overseas.	No.	
33	Claimants whose claims are processed by Federal or private relief departments or bills.	No.	
34	Civilian emergencies or civilians in a natural disaster.	No.	
35	Secretary of the AF	Yes.	Charge.
36	NATO personnel in U	Yes.	
37	Dependents of NATO personnel in US.	Yes.	Treat as US dependent. See AFRs 168-3 & 168-9. Possible charge.
38	Foreign military personnel other than NATO, inside US on a status officially recognized by a DOD agency.	Yes, only when authorized by Hospital Commander and only when not available commercially.	No charge.
39	Dependents of item 38.	No.	
40	Civilian employees of item 38.	No.	
41	Trainees under Military Assistance Program (MAP).	Yes, only when authorized by Hospital Commander and only when not available commercially.	Possible charge.
42	Dependents of MAP trainees.	No.	
43	Foreign personnel outside US.	No.	
44	Special category foreign Nationals outside US.	No.	
45	Foreign Nationals moved into US for medical care.	No.	
46	Dependents of Active Duty Uniformed Service personnel.	Refractions authorized within and without CONUS. Spectacles not authorized within CONUS for ordinary refractive errors.	
47	Dependents of Retired Uniformed Services personnel.	Refractions authorized within and without CONUS at most military installations. Spectacles may be sold under certain circumstances (AFR 168-9, para 4-7). Special lenses may be supplied free under certain circumstances (para 4-6p). CHAMPUS will cover eye exams for purpose of ruling out pathology, or may pay for civilian refraction under some circumstances (para 5-21). Services of an O.D. may be paid by CHAMPUS under some circumstances (para 5-2m). Routinely, eyeglasses are not supplied or paid for by CHAMPUS in CONUS (para 5-4d). Special Order Spectacle Program available overseas.	

Foldout 1. Personnel authorized optometric care at USAF medical facilities.

APPENDIX A

GENERAL INFORMATION ON CIVILIAN PARAOPTOMETRIC PERSONNEL TRAINING

PARAOPTOMETRIC PERSONNEL EDUCATION PROGRAMS

This is a list prepared periodically by the Division of Education and Manpower as a comprehensive list of existing programs. It is not intended to reflect any judgment of quality by the American Optometric Association or by the Council on Optometric Education.

OPTOMETRIC ASSISTANT PROGRAMS

COMMUNITY COLLEGE OF DENVER
NORTH CAMPUS
3645 W. 112th Ave.
Westminster, CO 80030
Judith Robinson

CONESTOGA COLLEGE
299 Door Valley Drive
KITCHENER ON CANADA
N2G 9Z9
Janet Page

ERWIN VOCATIONAL TECHNICAL
AREA CENTER
105 West Ross Ave.
Tampa, FL 33602
Mrs. Jewel Prater

FRESNO CITY COLLEGE
1101 East University Ave.
Fresno, CA 93714
G. M. Milkie, O.D.

GRANITE FALLS AREA VOCATIONAL
TECHNICAL INSTITUTE
Granite Falls, MN 56241
Mr. Eugene Manley

ITASCA COMMUNITY COLLEGE
Route 3
Grand Rapids, MN 55774
Earle Doelle, O.D.

LAKESHORE TECHNICAL INSTITUTE
1290 North Ave.
Cleveland, WI 53015
Ernest James, O.D.

MID-PLAINS COMMUNITY COLLEGE
Interstate 80 at Highway 83
North Platte, NE 69101
James E. Doyle

NORTH IOWA AREA COMMUNITY
COLLEGE
Health Programs Department
Mason City, IA 50401
Mr. Albert Singer

ST. CLOUD AREA VOCATIONAL
TECHNICAL INSTITUTE
1540 Northway Dr.
St. Cloud, MN 56301
Nancy Jeffers

UTAH TECH COLLEGE SKILLS CTR.
600 East
Salt Lake City, UT 84102
Cheryl Parsons, Director

PROGRAMS LEADING TO ASSOCIATE DEGREE

COLBY COMMUNITY COLLEGE
1255 South Range
Colby, KS 67701
Norman L. Burris, O.D.

COLUMBUS TECHNICAL INSTITUTE
550 East Spring
Columbus, OH 43215
Rita Pierce

FERRIS STATE COLLEGE
School of Allied Health
Big Rapids, MI 49307
F. M. Nista, O.D.

GREENVILLE TECHNICAL
P. O. Box 5616
Greenville, SC 29606
Rosalind Smith, O.D.

HARCUM JUNIOR COLLEGE
Bryn Mawr, PA 19010
David S. Hamilton, O.D.

HOWARD COMMUNITY COLLEGE
Columbia, MD 21044
Michael Kotlicky, O.D.

INDIANA UNIVERSITY
School of Optometry
Bloomington, IN 47401
Clifford W. Brooks, O.D.

MADISON AREA TECHNICAL COLLEGE
211 North Carroll St.
Madison, WI 53703
Paul Wheeler, O.D.

MERRITT COLLEGE
12500 Campus Dr.
Oakland, CA 94619
Will Kelley, O.D.

MIAMI-DADE JR. COLLEGE
Medical Center Campus
950 N. W. 20th St.
Miami, FL 33136
James Hartley, O.D.

NEWENCO
424 Beacon St.
Boston, MA 02116
Roger J. Wilson, O.D.

OWENS TECHNICAL COLLEGE
Oregon Road
Toledo, OH 43699
Barbara Oing

ST. PETERSBURG JR. COLLEGE
P. O. Box 13489
St. Petersburg, FL 33733
Mark J. Sarno, O.D.

SOUTHERN CALIFORNIA COLLEGE
OF OPTOMETRY
2001 Associated Rd.
Fullerton, CA 92631
Charles Margach, O.D.

SPOKANE COMMUNITY COLLEGE
N. 1810 Greene St.
Health Science Bldg.
Spokane, WA 99207
Cheryl Gibson

MILITARY INSTITUTIONS

COMMUNITY COLLEGE OF THE
AIR FORCE
Health Care Sciences Branch
Careers Division
Randolf AFB, TX 78148
Attention: CCAF/AYH

SHEPPARD AIR FORCE BASE
School of Health Care Sciences
Department of the Air Force
Sheppard AFB, TX 76311
Attention: MSDB/114

Paraoptometric Section

American Optometric Association

PARAOPTOMETRIC FACT SHEET

Thank you for your interest in the paraoptometric field. The following should answer some questions you might have regarding preparation and opportunities in the field of optometric assisting and technicianry:

HELPFUL HIGH SCHOOL COURSES: Algebra, bookkeeping, typing, English

ATTITUDES AND INTERESTS: Mature; emotionally stable; ability to handle people of all ages with tact; ability to follow routines and procedures

EDUCATIONAL PREREQUISITES: High school diploma or equivalent

ANNUAL INCOME: Although incomes vary greatly depending on the size and type of practice in which the paraoptometric is employed, geographical location and other factors, paraoptometrics generally earn starting salaries within the following broad ranges--
Assistants--$6,000 to $8,000
Technicians--$7,000 to $12,000

ASSISTANTS may be trained on the job or at an educational program. On the job training is available from many optometrists. Most optometrist employers who are interested in training a paraoptometric on the job may be located by contacting the local optometric society in your area or by consulting the Yellow Pages of the telephone book. Assistants interested in a formal training course should contact one of the programs on the enclosed list.

TECHNICIANS receive an associate in science or an associate of arts degree from a program on the enclosed list.

WRITE TO THE SCHOOL of your choice on the enclosed list for a catalogue and information on financial aid for a program in optometric assisting or technicianry.

AFTER YOU BECOME A PARAOPTOMETRIC, the American Optometric Association offers a variety of educational benefits through its Paraoptometric Section. Qualified assistants and technicians are also eligible to register with the AOA National **Paraoptometric Registry.**

APPENDIX B

SAMPLE STANDARD OPERATING PROCEDURES (SOP)

USAF CLINIC RAMSTEIN
OPTOMETRY CLINIC
OPERATING PROCEDURE

1. Introduction: The optometry clinic is staffed and equipped to provide required optometric services to military personnel stationed at Ramstein AB and several outlying stations. Vision care is also offered to authorized dependents and civilians on a space-available basis.

2. Duty Hours: Normal duty hours are from 0730 to 1630 hours weekdays. The clinic is closed on legal holidays and weekends. Limited service is provided during base exercises and alerts.

3. Manning: Service is provided by two 9256 Optometry Officers and two 912X5 optometry specialist/technicians.

4. Services Performed:
   a. Vision surveys.
   b. Visual analyses.
   c. Motor vehicle vision examinations.
   d. Visual field examinations.
   e. Cycloplegic refractions.
   f. Tonometric examinations.
   g. Color vision testing.
   h. Ocular motility testing.
   i. Ocular pathology detection/referral.
   j. Limited contact lens services (AFM 168-4, Chapter 8, Section L).
   k. Military spectacle ordering and dispensing.
   l. Special order civilian spectacle service.
   m. Frame modifications and repairs.
   n. Limited vision training procedures.

5. Personnel authorized optometric care: All active duty military patients are given priority appointments. Military dependents and retired military and their dependents receive second and third priority, respectively. Civilians assigned to military support organizations are seen on a space available basis at the option of the Director of Base Medical Services (DBMS). Fees are usually charged these patients and the Resource Management office determines the fee and collects the money.

6. Appointments: Military members may receive an appointment at a convenient time by calling RM 5644. Dependents are first given a vision survey to determine the extent of their problem. Vision surveys are performed each Tuesday between 0730 - 1100 and 1300 - 1600. No appointment is needed for this service, but medical records are required.

7. Occupational Vision Program. Special case-hardened lenses in safety frames may be ordered and dispensed under the provisions of AFR 161-31. This program is conducted under the immediate auspices of Ground Safety. Medical funds are not used to pay for these glasses, although the optical lab may fabricate limited numbers of case-hardened lenses under this program. FDA regulations require that *all* spectacles have impact-resistant lenses, but these lenses are not necessarily case hardened. See AFR 161-31 for ordering information.

8. Special Order Spectacle Program: A limited number of civilian spectacles are available at cost to those desiring this service. See para 12 for information on ordering these spectacles.

9. Spectacle Ordering and Dispensing: All military-type spectacles will be ordered IAW AFR 167-3. Einsiedlerhof Optical Lab supplies courier service to pick up the completed DD Forms 771 and deliver finished orders.

10. Contact Lenses: Contact lenses may be authorized at government expense (no charge to patient) for certain conditions listed in AFM 168-4, Chapter 8, Section L. Contact lenses for cosmetic purposes may be ordered at the discretion of the Hospital Commander and the Optometry Clinic. At the present time, no "cosmetic" contact lenses are being fitted in this facility.

11. Referral Service: For ophthalmological consultation, Landstuhl Army Medical Center may be called for an appointment 986-7378.

12. Operating Procedure:

a. Remember that patient care is our profession. We offer service to the patient and not vice versa. Try to be courteous with our patients at all times.

b. Patients may make appointments either in person or by phone. Patients who request appointments in person should be given an appointment slip. Patients who call for an appointment should have the appointment date and time repeated to insure accuracy. Military patients will have an appointment entered directly in the appointment book, while dependents will be told to attend the vision survey on any Tuesday. The survey may be waived in certain cases (such as broken glasses, etc.) at the discretion of clinic personnel. Medical records are required.

c. Any patient being given a vision survey will have an entry made in his medical record (SF 600) showing the date, visual acuities, phorias, and result of plus lens test (if given). This entry will be signed with the name, rank, and AFSC of the examiner. An accurate count of all patients surveyed will be kept by the examiner.

d. Prior to the day's appointments, place a copy of each doctor's patient list on his desk in the examining room.

e. When the patient arrives for his appointment:

(1) Stamp date and clinic on SF 600.

(2) Enter "Optometric Examination, see Form ." This entry should be signed by the examining optometrist or technician.

(3) Complete patient's identification data on appropriate exam form.

(4) Neutralize the patient's glasses and enter old prescription in space at top of form.

(5) Ask patient to be seated in the hall.

(6) Notify OD that his patient has arrived and place medical records on nurse's desk in examination room.

f. After the examination, if the patient needs no further services, he will be dismissed by the doctor, and the medical records will be placed in the hold basket. If the patient needs glasses, the technician will enter *all* necessary data on either the DD Form 771 or AE Form 1070 and prepare the form for the optometrist's signature. An order number, coinciding with the order number in the spectacle order logbook will be entered at the top of the DD Form 771. A voucher number will be assigned the AE Form 1070 only at the time the fee is paid. This voucher number will also be recorded in the SOSP logbook. The patient will also complete a notification card.

g. DD Forms 771 and AE Forms 1070 will be signed by the prescribing optometrist either at the beginning or end of each duty day. He will check the forms for errors and return them to the technician for processing. The technician will give each optometrist the DD Forms 771 or AE Forms 1070 for his own patients (do not mix patients). The medical records should also be available for checking by the optometrist.

h. After signature, the technician will remove the carbons from the signed forms, prepare copies 1 and 2 for transmittal to the optical lab, and numerically file copy 3 in the suspense file. The date ordered will be entered in the appropriate logbook. Order forms and transmittal sheets will then be placed in the yellow spectacle box for delivery by the courier. Medical records will be forwarded to Registrar personnel.

i. After spectacles are received from the lab.

(1) Verify all prescriptions with lensometer.

(2) Stamp date received in logbook and on copy 2 of DD Form 771 or AE Form 1070.

(3) Mail patient notification cards.

(4) File spectacles and copy 3 of order form alphabetically.

NOTE: Zweibruecken orders will be sent to the FSO, Zweibruecken. Place these orders in the brown box for pickup. Sembach orders should be placed in the appropriate cardboard box.

j. When the patient returns to pick up his glasses:

(1) Find appropriate glasses.

(2) Stamp logbook and copy 3 of DD Form 771 with "date dispensed" and have patient initial the logbook entry.

(3) Adjust frames.

(4) Dispense glasses and copy 3 of order form to patient.

(5) Copy 2 will be filed in medical records of patient. Patient should sign this copy next to "date dispensed."

k. Periodically check the order logs and/or spectacle cabinet for old prescriptions. Send second notification 2 months after date on order form.

l. Tracer requests to Einsiedlerhof will be initiated when prescription is 45 days old and not received. A DA 2496 will be mailed in 2 copies, with the third copy kept for file.

13. Count of patients: AF Forms 235, 235a and 235f are used to count patient visits. A draft of AF Form 235 and AF Form 235a will be prepared weekly, and submitted to the Resource Management office. The AF Form 235f will be submitted quarterly. AFM 168-420 describes the procedure for completing these forms. The basic source documents for these forms are the appointment logbook, tonometry register, and vision survey register.

14. Ordering supplies and equipment: Requests for office supplies will be phoned in to medical supply. Medical supplies and equipment will be ordered on an AF Form 1517 or AF Form 601B. Keep a record of all items ordered and the dates they were ordered and received.

LOUIS V. GENCO, Capt, USAF, BSC
OIC Optometry Clinic

APPENDIX C
FILES DISPOSITION PLAN

A	B	C	D
If documents are or pertain to	consisting of	which are	then
general correspondence (temporary)	letters, memoranda, and reports not covered elsewhere	categorized under any major subjective category (AFM 12-20) or are duplicate copies of files held elsewhere in the hospital	destroy after 1 year (Table 10-1, Rules 2 and 3).
reading file	extra copies of letters, messages, or other documents	used for periodic review by clinic staff	destroy 3 months after cutoff or when purpose has been served (Table 10-1, Rule 5).
office projects or studies	case files of management functions	not needed to document the project/study	destroy when purpose has been served (Table 10-1, Rule 10).
blank forms files	forms used in the clinic	prescribed by directives	destroy when superseded.
visual classification and qualifications	copies of tests administered as part of the process of classifying individuals reporting for induction		destroy after 1 year (Table 160-2, Rule 4)
visual standards for varied AF assignments	literature on vision, color vision, night vision, refraction, etc	used as basis for replying to correspondence and to establish standards	destroy when superseded, obsolete, or no longer needed (Table 160-2, Rule 5)
special survey reports	environmental/ public health reports	at performing activities	destroy selected material after 5 years (Table 161-5, Rule 1).
medical materiel reference records	catalogs, indexes	custodian copies	destroy when superseded or obsolete (Table 167-1, Rule 21).
source documents	issue/turn-in documents	identified in AFMs 67-1, 167-240, and AFP 167-2 to be returned	destroy 1 year after close of FY to which they pertain (Table 167-1, Rule 23).
		not identified in above publications	destroy after recording in document transaction register (Table 167-1, Rule 24).
using activity property records	monthly transactions		destroy after 1 year (Table 167-1, Rule 30).
due in/due out lists	inventory printouts	by document number of current due ins/ due outs	destroy 1 month after "as of date" (Table 167-1, Rule 6).
medical equipment maintenance records	work orders		destroy after purposes are served (Table 167-1, Rule 35).
	work order registers		destroy after 1 year (Table 167-1, Rule 34).
custodian account files	specimen signatures cost center information	individual files of personnel authorized to receipt for property	destroy 1 year after becoming superseded or obsolete (Table 167-1, Rule 41).

APPENDIX C (Cont'd)

A	B	C	D
medical services staffing	reports used for staffing and manpower requirements	copies of reports sent to HQ USAF	destroy after 3 years (Table 168-1, Rule 2).
spectacle issue and receipt records	documents indicating diagnosis and type of spectacles prescribed, and recording the receipt for spectacles issued;(may include DD Forms 771 and logbooks.)		destroy after 3 years (Table 168-2, Rule 6).
clinical records	clinical records of medical facility patients		file in record folder; further disposition by registrar.
health records	folders including outpatient treatment		maintain IAW AFMs 35-14, 162-1, and 168-4; further disposition by registrar.
report of patients	AF Form 235 series	below MAJCOMs	destroy after 2 years or when facility is inactivated (Table 168-2, Rule 2).
minutes of safety council meetings		generated by occupational vision committee	destroy after 1 year (Table 127-1, Rule 10).
standard operating procedures (SOPs)	written instructions prescribing a desired way of performing a local task	not issued as a standard publication	destroy when superseded, obsolete, or no longer needed, whichever is sooner (Table 11-1, Rule 10).
general reference publications	operational files of publications	not record copies; maintained for general reference	(Table 11-1, Rule 14)
official/staff visits	notifications of visits	at office visited	destroy on completion of visit (Table 11-2, Rule 19).
	reports of visits		destroy on completion of next visit (Table 11-2, Rule 17).

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APPENDIX D

SAMPLE SELF-INSPECTION CHECKLIST

1. What type of appointment system is used?
   a. Centrally controlled.
   b. Clinic controlled.

2. Are appointment books closed after a specific period of time or left open?

3. What priorities are used for appointments?
   a. By need.
   b. By status (AD, Dep AD, Ret, etc.).

4. What is the average waiting time for refractions?
   a. Military.
   b. Dependents.
   c. Retired.

5. How many refractions are scheduled per day per O.D.?

6. What is the estimated patient backlog?

7. What is the average time per "refraction" appointment?

8. What is the patient population?
   a. Percent military.
   b. Percent dependent.
   c. Percent retired.

9. What percentage of refractions result in NO new Rx?

10. Is there a screening program?

11. If so, what is the waiting time for screening?
    a. Military.
    b. Dependent.
    c. Retired.

12. How many screenings are done per week?

13. What is the clinic "no-show" rate?

14. Is the optometry clinic affiliated with an ophthalmology clinic?

15. If so, does the technician staff perform duties in both clinics?

16. What is clinic manning, parttime and fulltime?
    a. List AFSCs.

17. Does the OIC/NCOIC think this manning is adequate?

18. What are the major tasks performed by the 912X5?

19. Does the clinic offer routine:
    a. Tonometric exams.
    b. Visual field exams.

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c. Contact lens exams.
d. Subnormal vision exams.
e. Occupational vision exams.
f. Color vision exams.
g. Cycloplegic exams.
h. Vision training.
i. Other (list).

20. How many DD 771s are completed each month?

21. How many civilians Rxs are written each month?

22. Are all spectacle Rxs verified prior to dispensing?

23. Does the clinic have a written SOP?

24. Are there any significant managerial problems?

25. Are there any moral problems?

ANSWERS FOR EXERCISES

CHAPTER 1

References:

001 – 1. American Optometric Association and Southern Association of Colleges and Schools.
001 – 2. Base education office.
001 – 3. AOA National Registry for Paraoptometic Personnel.

002 – 1. Completion of training program, satisfactory performance in 5-skill-level job for 6 months, and recommendation by supervisor.
002 – 2. Successful performance of STS duties to 7 skill level.
002 – 3. Personnel holding a higher skill level require less supervision than those holding a lower skill level. The responsibilities of the higher skill level are greater, as are the demands for competence and efficiency.
002 – 4. Optometric assistant (or paraoptometric) technician.

003 – 1. Career knowledge training and job proficiency training.
003 – 2. Through STS study references.
003 – 3. It is a copy of the STS, annotated to identify the tasks done in a current job. It is developed by the supervisor (base optometrist) of the 912X5.
003 – 4. The newest Air Force publication.

004 – 1. The ophthalmology clinic or the primary care service.
004 – 2. It maintains the visual welfare of personnel whose primary function is to defend the country.
004 – 3. To provide optometric care to all authorized patients.
004 – 4. The answer obviously varies from clinic to clinic. In general, a clinic that offers many of the services listed in the text would be providing for its patients' visual welfare more comprehensively than the clinic with relatively few of the services.

005 – 1. Unsafe personal attitudes.
005 – 2. AFR 127–4 and AFM 127–2.
005 – 3. AF Form 711, USAF Mishap Report.
005 – 4. Overloaded receptacles, frayed extension cords, improper wattage circuit breakers, and ungrounded equipment.
005 – 5. The answer to this question will vary from clinic to clinic. Typical answers might be:

Condition	*Remedy*
Frayed electrical cables.	Replace cable.
Instruments on unstable tables.	Order stronger tables.
Bad valve on hydraulic chair.	Inform MER: Initiate work order.
Diagnostic drugs outdated.	Replace.

005 – 6. Stop bleeding and prevent contamination.
005 – 7. Prevent contamination, relieve pain, and treat shock.
005 – 8. Get the patient away from the electrical source.

CHAPTER 2

006 – 1. When the patient gives the doctor permission.
006 – 2. Patient-doctor communications are not held to be privileged information in the Armed Forces.
006 – 3. It is confidential in that it may lead to injury to the patient, but it is unclassified information because it is of no probable importance to the security of the U.S.

007 – 1. Courtesy—Keep smiling even if it hurts.
Attention—Our job is to take care of people; we have to render them service.
Self-confidence—Don't try to give anybody a snow job, but realize that you have pretty good capabilities.
Ethics—Don't "bad mouth" other personnel. Take care of problems that arise in the clinic.
Don't use your position in the clinic for personal gain.
007 – 2. The reputation of every member of the medical facility.
007 – 3. The patient's needs.

008 – 1. This depends on how much of the test has been completed. If you have not completed the first eye and the patient is tired, give the patient a break and answer the phone. You may start all over again at a later time or date. If you are almost finished with the patient, complete the exam and hope the noise won't disturb concentration too much. Above all, don't rush your exam. The caller will try again later, anyway.
008 – 2. First, try to take a message and have the doctor call back. If this doesn't satisfy the caller, take a short message and hand it to the doctor. A small hint: If the message really isn't that important, or if the caller won't give you the message, the "hold" button may be quite convenient.

CHAPTER 3

009 – 1. a. Yes.
b. No.
c. No.
d. No.
e. Yes.
f. Yes.
g. No.
h. Yes.
009 – 2. a. Both; no fee.
b. N/A.
c. N/A.
d. N/A.
e. Both; no fee.
f. Exam only; no fee.
g. N/A.
h. Exam only; no fee.
009 – 3. a. Yes.
b. No.
c. No.
d. No.
e. No.
f. Yes.
g. Yes.
h. Yes.
009 – 4. a. Both. No fee except for S.O.S.P. glasses.
b. N/A.
c. N/A.
d. N/A.
e. N/A.
f. Both. No fee except for S.O.S.P. glasses.
g. Both. When not commercially available and when authorized; a fee is charged.
h. Both. No fee except for S.O.S.P. glasses.
009 – 5. (1) Navy seaman.

(2) Dependent daughter of Army SFC.
(3) Dependent mother-in-law of retired MSgt.

010 - 1. Military priority system combined with preliminary triage. Due to the relatively low backlog, most patients can be seen by the optometrist without a screening. The multiple duties would keep the 912X5 busy with spectacle orders and additional tests. Military priority system should be used to give the G.I. precedence.
010 - 2. Military priority system (same reason as above). Preliminary triage with increased flow to vision screening clinic. Possible cut-off date after one month. These systems would be instituted to allow the doctor to see the patients with a greater need for refraction, and to allow a reasonable waiting time for appointments without interference from other hospital functions and meetings.
010 - 3. Make a full screening on all prospective patients. Classify them according to need, and send the most needy to a local civilian O.D. for examinations at Government cost. The "next most needy" would be seen first by the new military O.D. Of course, military have priority here. Also, the patients may want to see a civilian O.D. of their own volition.

011 - 1. Loss or breakage of spectacle over 1 year old, referral from another service, school referrals, reappointments, etc.
011 - 2. Acute eye pain, sudden onset of headaches not associated with visual tests, external or internal eye disease, etc.
011 - 3. Vague complaints of visual discomfort or blurred vision, loss or breakage of recent spectacles when the prescription is available, and driver's license examinations, etc.

012 - 1. Name of patient, date and time of appointment, name of clinic, and number of previously broken appointments (if available).
012 - 2. The OIC of the sponsor's organization.
012 - 3. The commander of the individual's organization.

013 - 1. DD Form 741, Eye Consultation.
013 - 2. SF 513, Medical Record—Consultation Sheet.
013 - 3. SF 600, Health Record—Chronological Record of Medical Care.
013 - 4. DD Form 771, Eyewear Prescription.
013 - 5. Left side.
013 - 6. Right side, under the 600s.
013 - 7. Right side, in chronological order.
013 - 8. Left side.

014 - 1. Resource Management.
014 - 2. Proper documentation.
014 - 3. The doctor.
015 - 4. Legibility.

CHAPTER 4

015 - 1. General neatness and orderliness, availability of appointment and logbooks, availability of medical records and exam forms, environment temperature and ventilation control, etc.
015 - 2. Instrument cleanliness, placement, and operability.
015 - 3. Arrangement and availability of tools and repair parts, operability of frame warmer and other dispensing equipment, neatness of area, cleanliness of sample frames, etc.
015 - 4. Complete exam forms before the patient arrives, and check records to see whether a patient needs special test equipment. (Have this equipment ready *before* the patient arrives.)
015 - 5. Filing of medical records and spectacle order forms; requests for medical records for the next day; orderliness and filing of spectacles; equipment covered and turned off; furniture straightened; general cleanliness and neatness; windows and doors closed, etc.

016 - 1. Familiarize new personnel with clinic procedures and policies in order to maintain a continuous standardized service to the patients.
016 - 2. Introduction; duty hours; staffing summary; list of services performed; list of personnel categories authorized care; appointment procedures; procedures to order glasses; procedures to order contact lenses; procedures to refer patients; and procedures to account for patients, etc.
016 - 3. a. The SOP is not a standard publication, while the operating instruction is.
b. The SOP may be written by any knowledgeable clinic member, but the OI may be written only by the chief of the section or clinic.

017 - 1. Have each individual list all the tasks performed and how much time is spent on each.
017 - 2. To insure equitable distribution of work and to help prepare duty rosters, position descriptions, and requests for personnel.
017 - 3. It identifies the knowledges and skills necessary for a particular position.

018 - 1. AFM 26-3, *Air Force Manpower Standards*, and AFM 168-695, *MAMS—Medical Administrative Management System*.
018 - 2. Verify the number of refractions each month and compare this figure to technician Authorizations Refractions per month listed in AFM 26-3.
018 - 3. Eliminate special clinics, schedule more refractions each day, give up afternoons off, work longer hours each day, fill "no-show" slots with walk-in patients, etc.
018 - 4. Approximately 12 months.

019 - 1. Official immediately supervising the reporting official on the closing date of the report.
019 - 2. Immediate supervisor of the ratee.
019 - 3. Disagreement (between the indorsing official and either the reporting official or a previous indorsing official) that results in a change in section III of 3 or more boxes in any item, or 1 or more boxes in 3 or more items, or a change in section IV of 1 or more boxes.
019 - 4. Fair and equal consideration for promotion, visibility, and objectivity.
019 - 5. 1/6 point for each month of active service up to 40 points; 15 or more days count 1/6 point, drop less than 15 days.
019 - 6. 460.
019 - 7. Add all APR scores (0 to 9) of the last 5 years not to exceed 10 APRs. Divide the sum by the number of APRs used. Multiply by 15.
019 - 8. Three.
019 - 9. 160.
019 - 10. Master sergeant, technical sergeant, and staff sergeant.

020 - 1. Get ready to receive the new worker, welcome the new worker, show genuine interest in the worker, explain the work of the unit, introduce to the chief of the unit and coworkers, show the layout and availability facilities, explain rules and regulations, instruct in job or assign to a qualified instructor, and follow up.
020 - 2. 3ABR91235 study guides and workbooks and this CDC.
020 - 3. Preparation of work breakdown for each airman, instruction of trainees on clinic equipment, teaching theory and background information, motivating and evaluating trainees, etc.
020 - 4. Locate and read the job description and OJT folder, accept and react favorable to motivational efforts of trainers, budget study time properly, and keep training materials in good condition.

CHAPTER 5

021 - 1. The media through which are announced AF policies, procedures, and instructions.
021 - 2. Departmental and field.
021 - 3. Regulations (AFRs), manuals (AFMs), and pamphlets (AFPs). Many AFMs are being changed to AFRs or AFPs. The only AFMs will be nondirective and not either entirely informational or instructional.
021 - 4. AFR 0-2.
021 - 5. Request the publication in writing from the Hospital Sgt. Major. Include the publication number, title, number of copies needed, and the reason you need them.
021 - 6. The hospital librarian or a medical supply clerk.

022 - 1. AFM 12-20, *Maintenance of Current Documentation*.

022 - 2. AFM 12—50.

022 - 3. General correspondence, lab newsletters, optometry newsletters, patients' correspondence, blank forms, environmental survey report, medical material source documents, medical custodian receipt records, using activity property records, due in/out lists, medical equipment maintenance records, custodian account files, spectacle issue and receipt records, staffing reports (copies), report of patients (copies), standard operating procedures, general reference publications, and official and staff visits. (Obviously, your answer may differ somewhat.)

022 - 4. AF Form 80, Files Maintenance and Disposition Plan.

022 - 5. AF Form 82, Files Disposition Control Label.

023 - 1. Shortness, simplicity, strength, and sincerity.

023 - 2. Where it came from, to whom to reply, what it is about, for whom it is intended, and when it was mailed.

023 - 3. It should be selected with the type of reader in mind.

024 - 1. Your checklist probably has most of the items in Appendix D. Items that should be covered regardless of clinic size are type of appointment system, priorities for appointments, average waiting time for refractions, how many refractions are done daily, and estimated backlog.

CHAPTER 6

025 - 1. (1) d.
(2) a.
(3) c.
(4) e.

026 - 1. 6515 and 6540.

026 - 2. Glossary of colloquial names and therapeutic index, C-6505-GL.

026 - 3. The item is discontinued.

026 - 4. No place. The index number is used to locate an item in the catalog, not to order it.

026 - 5. D—item centrally stocked.
L—item authorized for local purchase.

026 - 6. Nonexpendable.

026 - 7. Expendable.

026 - 8. Expendable.

027 - 1. DD Form 1348(en6.

027 - 2. AF Form 601b.

027 - 3. DD Form 1348–6.

027 - 4. AF Form 601b and DD Form 1348–6.

027 - 5. DD Form 1348–6.

027 - 6. AF Form 601b and DD Form 1348–6.

028 - 1. Medical equipment repair.

028 - 2. In the spare parts manual packed in the shipping box.

028 - 3. Good housekeeping.

STOP- 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

91255 01 23

OPTOMETRY CLINIC ADMINISTRATION

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

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MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (001) If you wish to join the civilian organization for optometry assistants, to whom would you write?

   a. AOA National Registry for Paraoptometric Personnel.
   b. Base Education Office.
   c. American Optometric Association.
   d. Southern Association of Colleges and Schools.

2. (001) The Community College of the Air Force offers an associates degree in Optometric Technology which requires a total credit hours of

   a. 58.
   b. 60.
   c. 64.
   d. 66.

3. (002) Where are the basic criteria or levels of achievement that must be attained for award of the 7-level listed?

   a. SKT-PFE study material.
   b. Career Development Course.
   c. Specialty Training Standard.
   d. Airman Classification Manual.

4. (002) You may be awarded the 7-level after successful completion of

   a. SKT-PFE exam.
   b. retaking 5-level exam.
   c. writing a thesis on optometry.
   d. prescribed on-the-job training.

5. (002) If you are interested in becoming an optometrist, you should check with the

   a. American Optometric Association.
   b. American Medical Association.
   c. American Optical Company.
   d. Base Education Office.

6. (002) According to AFR 39-1, Airman Classification Regulation, what is the main difference between a 3-level and 5-level job description?

   a. Amount of supervision received.
   b. Amount of supervision given.
   c. Amount of time off.
   d. None whatsoever.

7. (003) Whose responsibility is it to develop and ensure effective use of your Job Proficiency Guide?

   a. The trainee.
   b. Unit training advisor.
   c. Supervisor.
   d. Endorsing official.

8. (004) At the present time, optometry clinics located in medical facilities not having an ophthalmology clinic are a subelement of

   a. Air Force clinics.
   b. primary care services.
   c. Flight Surgeon's office.
   d. outpatient care clinic.

9. (004) At the present time, optometry clinics located in medical facilities that have both ophthalmology and primary care services, optometry falls under

   a. Ophthalmology.
   b. Primary Care Services.
   c. Flight Surgeon's office.
   d. Air Force Non-medical clinics.

10. (004) The eye clinic can best carry out the responsibility of preventing eye trauma by

    a. spectacle repairs.
    b. contact lens services.
    c. visual analyses.
    d. eye safety programs.

11. (005) What publications do you use when submitting an accident report?

a. AFR 127-4 and AFM 127-2.
b. AFM 168-4 and AFR 39-1.
c. AFR 169-695 and AFM 127-3.
d. AFM 136-7 and AFR 136-6.

12. (005) Acetone should be stored in

a. the emergency room.
b. a wooden cabinet.
c. a metal cabinet.
d. a storage room.

13. (005) What is the cause for most minor injuries in the optometry clinic?

a. Frame warmer.
b. Lensometer.
c. Examining chair.
d. Tonometer sterilizer.

14. (005) Which of the following should you do *first* after incurring a minor burn in the optometry clinic?

a. Apply an antibiotic to the burn.
b. Apply an anesthetic to the burn.
c. Exclude air from the burn to relieve pain.
d. Turn off the hot instrument and apply cold water to the burn.

15. (006) The practice of *not* talking about patient's medical problems to unauthorized personnel is called

a. confidentiality.
b. classified information.
c. incommunicability.
d. privileged information.

16. (007) What is the best defense the optometry specialist has against an overdemanding patient in the clinic?

a. Verbal retaliation.
b. "Pass the buck."
c. Offer fewer services.
d. Performing duties efficiently.

17. (008) Which of the following has the most influence on the reputation of your clinic?

a. The appointment desk.
b. The red cross work.
c. You, the technician.
d. The records section.

18. (007) Your behavior while on duty in the optometry clinic should *primarily* satisfy the needs of

a. yourself.
b. your patients.
c. your optometrists.
d. the hospital commander.

19. (008) Proper telephone technique when calling someone to the telephone is to

a. interrupt the called party and give the message.
b. place the phone on hold and wait for the called party to appear.
c. place your hand over the mouthpiece and yell for the called party to answer phone.
d. ask the caller to stand by and then inform the called party of an incoming call.

20. (008) What do you do if a caller insists on speaking with the doctor?

a. Insist on taking a message.
b. Say you're sorry and hang up.
c. Write callers name on slip of paper and give to doctor.
d. Put them on hold till the doctor is free.

21. (009) What Air Force directive indicates those personnel authorized optometric care in a USAF medical facility?

a. AFR 168-6.
b. AFR 168-4.
c. AFM 160-1.
d. AFM 160-4.

22. (010) Which patient scheduling system is the *least* efficient for visual analyses in the optometry clinic?

a. Walk-in.
b. Vision survey.
c. Military priority.
d. Preliminary triage.

23. (010) Which patient scheduling system is the best but not the most popular system?

a. Preliminary triage.
b. Walk-in.
c. Vision screening.
d. Military priority.

24. (011) Assuming a patient has just called to request an appointment, which of the following statements would alert you to give a survey or screening appointment?

a. "I want to have my yearly eye examination."
b. "My eyes are all red and blood shot when I wake up."
c. "Johnny broke his glasses and cannot see the chalkboard."
d. "The doctor wanted me to come back for a re-examination in 6 months."

25. (012) To whom should a dependent "no show" letter be addressed?

a. The dependent.
b. The dependent's sponsor.
c. The sponsor's OIC.
d. The sponsor's commander.

26. (012) Where is the oldest dated SF 513 placed in the medical records?

a. Right side and on top.
b. Left side and on top.
c. Right side and on bottom.
d. Left side and on bottom.

27. (014) At the end of each day, the patient count is turned over to the

a. Registrars Office.
b. Primary Care Clinic.
c. Resource Management Office.
d. Orderly room.

28. (014) In order to support the audit trail, your log lists must contain

a. appointment times.
b. sponsor's SSAN.
c. sponsor's organization.
d. sponsor's phone number.

29. (014) On what basis should appointment logs be sent to resource management?

a. Daily.
b. Weekly.
c. Biweekly.
d. Monthly.

30. (014) What manual provides guidelines for the audit trail?

a. AFM 168-4.
b. AFM 168-6.
c. AFM 168-695.
d. AFM 168-702.

31. (014) Telephone consultations are reportable as technician visits if the

a. call lasts more than 5 minutes.
b. patient visits the clinic later that day.
c. patient's medical records are documented.
d. the call involves pathology of the eye.

32. (014) If the optometry specialist and the optometrist treat the same patient on the same day and the optometry specialist provides the principal service, who, if anyone, should receive credit for the visit?

a. Optometry Specialist.
b. Optometrist.
c. Optometrist and Specialist.
d. Visit is not a countable visit.

33. (015) How often should you change the face plates in the phoropter unit?

a. Semi-monthly.
b. Weekly or monthly depending on the amount of use.
c. Weekly.
d. Daily.

34. (015) What action should you take to conserve electrical energy with respect to the frame warmer?

a. Turn off at end of the day.
b. Use low voltage when adjusting metal frames.
c. Turn on before immersing and turn off after removing the frame.
d. Use glass beads so the heat will be contained more effectively.

35. (015) Normal housekeeping chores in your optometry clinic should be

a. accomplished only when required.
b. performed on a daily basis.
c. performed only by a 3-level specialist.
d. left to the janitorial service personnel.

36. (016) What information listed below should *not* be included in a standard operating procedure?

a. Services available in the eye clinic.
b. A list of the forms used in the clinic and procedures for completing them.
c. Procedures describing how to refer a patient to another optometry clinic.
d. A directive written under the direction of AFR 5-1, Air Force Publications Management Program.

37. (017) How should you use the Speciality Training Standard when preparing position descriptions?

a. Use the STS as it exists with the exception of the administration tasks.
b. Use the STS as it exists and tailor local tasks to fit standard.
c. Interpret the listed tasks to agree with the local procedures.
d. Omit tasks as necessary from the STS but do not add new tasks.

38. (018) Which of the following directives contains the Air Force Manpower Standards?

a. AFR 0-2.
b. AFM 26-3.
c. AFR 168-4.
d. AFM 168-695.

39. (018) Which of the following statements is true concerning patient visits used to justify 912X5 manpower positions?

a. Most visits are countable.
b. Only screening exams are counted.
c. Only refractions are counted.
d. Only special clinic visits are countable.

40. (018) If three optometrists do an average of 880 refractions each month, how many technicians would your clinic be authorized?

a. One.
b. Two.
c. Three.
d. Four.

41. (019) The individual who qualifies as the reporting official with respect to an Airman Performance Report is the

a. additional indorsing official.
b. person causing the "significant disagreement."
c. indorsing official's immediate supervisor.
d. ratee's immediate supervisor.

42. (019) What rating in Section IV of an Airman Performance Report constitutes a referral report?

a. An entry in at least one of the two lower rating boxes.
b. An entry in at least one of the three lower rating boxes.
c. An entry in at least two of the three lower rating boxes.
d. A comment reflecting substandard personal conduct.

43. (019) Which of the following statements *best* describes an advantage of the Weighted Airman Promotion System (WAPS)?

a. Longevity is not a significant factor.
b. Objectivity is eliminated
c. Visibility is not necessary.
d. Subjectivity is minimized.

44. (019) How many points would you receive for time in grade (TIG) under the WAPS if your total time in your current grade is 1 1/2 years?

a. 9.
b. 15.
c. 18.
d. 36.

45. (020) How can you use study guides and workbooks from Course 3ABR91235 and this CDC to assist you when training other worker?

a. As study references.
b. By indicating the code needed for upgrading.
c. To determine task difficulty.
d. By following the training principles.

46. (021) What class or classes of Air Force publications originate at the major air command level or below?

a. Field publications only.
b. General military regulations.
c. Departmental publications only.
d. Field and departmental publications.

47. (021) What information would you expect to find in AFR 0-2?

a. Procedures regarding the administration of medical facilities?
b. Instructions pertaining to optometry records.
c. An alphabetical listing of publications.
d. A numerical index of publications.

48. (021) Supplements to Air Force publications are issued at

a. Air Force level.
b. Major Air Command *only*.
c. Numbered Air Force at US bases *only*.
d. Lower command level than command publishing original.

49. (022) What publication defines material that constitutes documentation?

a. AFR 12-1.
b. AFM 12-20.
c. AFM 12-50.
d. AFM 168-4.

50. (022) What publication provides guidelines for disposing of Air Force documentation?

a. AFM 12-1.
b. AFM 12-20.
c. AFM 12-50.
d. AFM 168-4.

51. (022) Where is the original copy of AF Form 80, Files Maintenance and Disposition Plan, filed?

a. Behind the AF Form 82.
b. In front of the current files.
c. With the largest section of the files.
d. In the documentation manager's office.

52. (022) In what publication would you find a listing of the types of filing equipment authorized for storing official documentation?

a. AFM 168-4.
b. AFM 12-50.
c. AFM 12-20.
d. AFR 12-1.

53. (023) Which of the following questions should be answered in the body of a USAF letter?

a. What and where.
b. When and who.
c. What and how.
d. Why and how.

54. (023) A thorough knowledge of the subject matter of a letter you intend to write may help you to keep the letter

a. short.
b. strong.
c. simple.
d. sincere.

55. (023) When writing a letter to one of your optometry patients, what rule should you follow with reference to the language of the letter?

a. Use nontechnical language if possible.
b. Do not refer to optometry equipment.
c. Use technical language to ensure accuracy.
d. Do not use any word contained in a medical dictionary.

56. (024) Before coming to your clinic, inspectors will normally check previous inspection

a. plans.
b. goals.
c. dates.
d. reports.

57. (024) Which of the following is the most valid reason for having a screening program?

a. Equipment and facilities.
b. Clinic manning.
c. Sex of patient population.
d. Age of patient population.

58. (024) If you have a large backlog and not enough personnel, equipment, or facilities to reduce this backlog, you should

a. record the time in operations.
b. document the facts.
c. assign priorities.
d. review the clinic morale.

59. (025) The property custodian is appointed by the

a. Medical Supply Officer.
b. Chief of Administration.
c. Director of Professional Services.
d. Director of Base Medical Services.

60. (025) Who prepares AF Form 601, Custodian Request/Receipt, when property is transferred from one account to another?

a. The records clerk.
b. The losing account custodian.
c. The gaining account custodian.
d. Medical supply personnel.

61. (025) If the preliminary survey indicates negligence, which of the following circumstances requires a Report of Survey?

a. An item valued at $600.00 is lost.
b. An individual admits pecuniary liability.
c. A property custodian mismanages the account.
d. An item costing $237 is damaged.

62. (026) What supply publications show the name, stock number, description, and pictures of instruments, equipment, and supplies?

a. Alphabetical index.
b. Computer data index.
c. Identification lists.
d. Management data lists.

63. (026) What class of supply items includes optician's instruments, equipment, and supplies?

a. FSC 6505.
b. FSC 6514.
c. FSC 6515.
d. FSC 6540.

64. (026) What information is provided under "Notes" in the National Supply System?

a. Availability.
b. Unit cost.
c. Special storage and handling requirements.
d. Addition, deletion, or revision of published data.

65. (026) What does the symbol G indicate in the symbol column of the National Supply System Notes?

a. Alcohol.
b. Flammable.
c. Requires refrigeration between 2° C. and 8° C.
d. Must be frozen for preservation.

66. (026) Which of the following is a characteristic of supply or equipment items that are *not* classified as expendable?

a. 4 years life expectation.
b. 7 years life expectation.
c. Consumed within 90 days.
d. Cost less than $500.

67. (026) Which of the following items are classified as expense?

a. Items costing $100 to $250.
b. Items costing $100 to $999.99.
c. Items costing $300 to $2999.99.
d. Items over $3,000.

68. (027) What form is usually used to order a standard or nonstandard item costing more than $300?

a. DD Form 771.
b. AF Form 601.
c. AF Form 2005.
d. AF Form 1348-6.

69. (028) Who has the primary responsibility for repairing optometry clinic equipment?

a. The optometry officer.
b. The equipment manufacturer.
c. The medical equipment repairers.
d. The optometry specialists or technicians.

70. (028) As an optometry specialist, you can most effectively insure that your equipment does *not* become defective by

a. practicing good housekeeping procedures and handling the equipment carefully.
b. contracting the maintenance of sensitive equipment to a commercial firm.
c. ensuring that medical equipment repairers perform periodic inspections of the equipment.
d. maintaining a complete stock of repair parts and replacing those within your capability.

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY 10 USC 8012 and EO 9397. PRINCIPAL PURPOSES: To provide student assistance as requested by individual students. ROUTINE USES This form is shipped with ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. DISCLOSURE Voluntary The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance to the student.

SECTION I: CORRECTED OR LATEST ENROLLMENT DATA: *(Mail to ECI, Gunter AFS AL 36118)*

1 THIS REQUEST CONCERNS COURSE (1 6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4 AUTOVON NUMBER
5 SOCIAL SECURITY NUMBER (7 - 15) - -	6 GRADE/RANK	7. NAME *(First initial, second initial, last name)* (17) (18) (19-32)	

8 ADDRESS *(OJT Enrollees -- Address of unit training office with zip code. All others -- current mailing address with zip code.)*

(33-53)

(54-75)

9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE

10 TEST CONTROL OFFICE ZIP CODE/SHRED (33 39)

SECTION II: REQUEST FOR MATERIALS, RECORDS, OR SERVICE

(Place an 'X' through number in box to left of service requested)

1	Request address change as indicated in Section I.
2	Request Test Control Office change as indicated in Section I.
3	Request name change/correction (Provide Old or Incorrect data)
4	Request Grade/Rank change/correction.
5	Correct SSAN. (List incorrect SSAN here) (Correct SSAN should be shown in Section I)
6	Extend course completion date. (Justify in REMARKS)
7	Request enrollment cancellation.
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 Originals were: ☐ Not received ☐ Lost ☐ Misused
9	Send course materials. (Specify in REMARKS) ☐ Not received ☐ Lost ☐ Damaged
10	Course exam not yet received. Final VRE submitted for grading on ________________ (date).
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 not yet received. Answer sheet(s) submitted ________________ (date).
12	Results for CE not yet received. Answer sheet submitted to ECI on ________________ (date).
13	Previous inquiry (☐ ECI Fm 17, ☐ Ltr, ☐ Msg) sent to ECI on ________________ (date).
14	Give instructional assistance as requested on reverse.
15	Other (Explain fully in REMARKS)

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16		
G	33	
K	Vol 33 - 35	GR 36 38
M	33 34	35 40
N	33 38	
P	Vol 33 - 35	TC 36 37
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16		

REMARKS *(Continue on Reverse)*

OJT STUDENTS must have their OJT Administrator certify this request. ALL OTHER STUDENTS may certify their own requests.	I certify that the information on this form is accurate and that this request cannot be answered at this station. *(Signature)*

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(PREVIOUS EDITIONS MAY BE USED)

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11

SECTION III: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

VRE Item Questioned:

Course No ________

Volume No ________

VRE Form No ________

VRE Item No ________

Answer You Chose ________ (Letter)

Has VRE Answer Sheet been submitted for grading?

☐ Yes ☐ No

REFERENCE

(Textual reference for the answer I chose can be found as shown below)

In Volume No ________

On Page No ________

In ☐ left ☐ right column

Lines _____ Through _____

MY QUESTION IS:

REMARKS

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. Course workbooks have a Form 17 printed on the last page.

91255 02 8210

CDC 91255

OPTOMETRY SPECIALIST

(AFSC 91255)

Volume 2

Preliminary Clinical Procedures

Extension Course Institute

Air Training Command

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EXTENSION COURSE INSTITUTE, GUNTER AIR FORCE STATION, ALABAMA

THIS PUBLICATION HAS BEEN REVIEWED AND APPROVED BY COMPETENT PERSONNEL OF THE PREPARING COMMAND IN ACCORDANCE WITH CURRENT DIRECTIVES ON DOCTRINE, POLICY, ESSENTIALITY, PROPRIETY, AND QUALITY.

Preface

THUS FAR you have been reeducated on your career field, on what you have to put out to get upgraded, and clinic administration. Your next area of study will cover anatomy and physiology of the ocular system and the varied screening tests with which your doctor will need you to be familiar. You will be reintroduced to the Vision Test Apparatus, Near and Distant. Also, you will become more familiar with the Keystone Telebinocular Stereoscope. The screening tests will involve color vision, night vision, stereopsis, and depth perception. Along with those are fusion, accomodation, Schirmer test test, and blood pressure.

For easy reference, Appendixes A through C have been included in this volume. Use them as the text directs.

Direct your questions or comments relating to the accuracy or currency of this volume to the course author: School of Health Care Sciences, USAF/MSTW, ATTN: TSgt Michael O. Kille, Sheppard AFB TX 76311. If you need an immediate response, call the author, AUTOVON 736-4471 between 0800 and 1600 (CST), Monday through Friday. *(NOTE: Do not use the suggestion program to submit changes or corrections for this course.)*

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This volume is valued at 27 hours (9 points).

Material in this volume is technically accurate, adequate, and current as of February 1982.

Acknowledgment

THE KEYSTONE skills score sheet (cummulative form 3A) found in Appendix C was copied with permission of Mast/Keystone Company. The material covered by this permission may be placed on sale in the Government Printing Office.

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CHAPTER 1

NOTE: In this volume, the subject matter is developed by a series of Learning Objectives. Each of these carries a 3-digit number and is in boldface type. Each sets a learning goal for you. The text that follows the objective gives you the information you need to reach that goal. The exercises following the information give you a check on your achievement. When you complete them, see if your answers match those in the back of this volume. If your response to an exercise is incorrect, review the objective and its text.

Vision Screening

THE FIRST VOLUME investigated some of the administrative procedures tied to patient treatment. Now let's explore ocular anatomy and physiology and some of the clinical procedures you will perform.

1-1. Anatomy and Physiology of the Eyelids

You are not authorized to diagnose patients' problems. However, you do need a first-class background in eye anatomy and physiology. You must be able to discuss patients' problems with your optometrist.

200. Identify parts of the anatomy of the eyelids by name and by location.

The eyelids are folds of tissue that form almond shaped openings in front of the eyes. Their primary purpose is protection. Eyelids help limit the amount of light entering the eye and aid in keeping dust, dirt, and fingers out of the eye.

The Landmarks. The lateral canthus, medial canthus, plica semilunaris, and caruncle are anatomical landmarks. They do not perform any visual function. The lateral canthus is the meeting point of the upper and lower lids on the temporal side of the eye. The medial canthus is the meeting point on the nasal side. The plica semilunaris and caruncle are located in the medial canthus. The plica is thought to be the remnant of a third eyelid. The caruncle is a fleshy mound of tissue located between the plica and the point where the two lids join. Figure 1-1 shows the anatomical landmarks.

The Muscles. Each eyelid has muscles that open and close the lids. The levator palpebrae superioris and muscle of Muller open the lids. The levator originates at the apex of the orbit and attaches to the sheath of the superior rectus muscle, the tarsal plate, and to the lid margin. Refer to figure 1-2, the eyelid. The oculomotor (3rd cranial) nerve innervates the levator.

The muscle of Muller originates from the levator and attaches to the tarsal plate. This muscle holds the lids open and against the eyeball. It is also the muscle that opens the lids wider for the "surprised look." Sympathetic nerve fibers innervate the muscle of Muller.

The orbicularis oculi and Riolan's muscle close the lids. The orbicularis originates in the tissue near the medial and lateral canthus. It has no point of insertion because it is a circular (sphincter) shaped muscle. The facial (7th cranial) nerve innervates the orbicularis and Riolan's muscle. Riolan's muscle is a portion of the orbicularis located at the lid margins between the tarsal plate and lash follicles. Riolan's muscle brings the lid margins together as the lid closes and holds the lids against the eyeball.

The Tarsal Plate. As already mentioned, the tarsal plate is the point of insertion for the levator and the muscle of Muller. It also forms the skeleton of the eyelids. The tarsal plate is made up of tough fibrous tissue and is the structure that makes it possible to evert the upper eyelid. It is larger in the upper lid than in the lower lid and contains glands that secrete an oily substance. Figure 1-2 shows where the tarsal plate is located in the upper lid.

The Eyelashes. The eyelashes are hairs located on the lid margins. The upper lid has about twice as many lashes as the lower. Eyelashes form a first line of defense for the eye. Each hair follicle is surrounded by a network of supper sensitive nerves that cause the lids to slam shut. A speck of dust touching an eyelash can trigger this reaction.

The Glands. Each eyelid contains glands that secrete oils and tears. The glands of Zeis, located at the base of each eyelash, are sebaceous glands. They secrete an oily material that lubricates the eyelashes, keeps the lid margins from sticking together, and mixes with the tear layer. The meibomian glands are also sebaceous glands. These are the glands located in the tarsal plate (see fig. 1-2). The oil from the meibomian glands and the glands of Zeis mix with the precorneal tear layer and reduce evaporation of tears.

The glands of Wolfring and Krause are accessory tear glands. These glands are located in the palpebral conjunctiva, the innermost layer of the eyelid.

The Conjunctiva. Conjunctiva is a general term used to identify the layer of protective tissue that covers the back surface of the eyelids and front surface of the eyeball. It is anatomically broken down into three parts: (1) palpebral conjunctiva on the eyelids, (2) bulbar conjunctiva on the

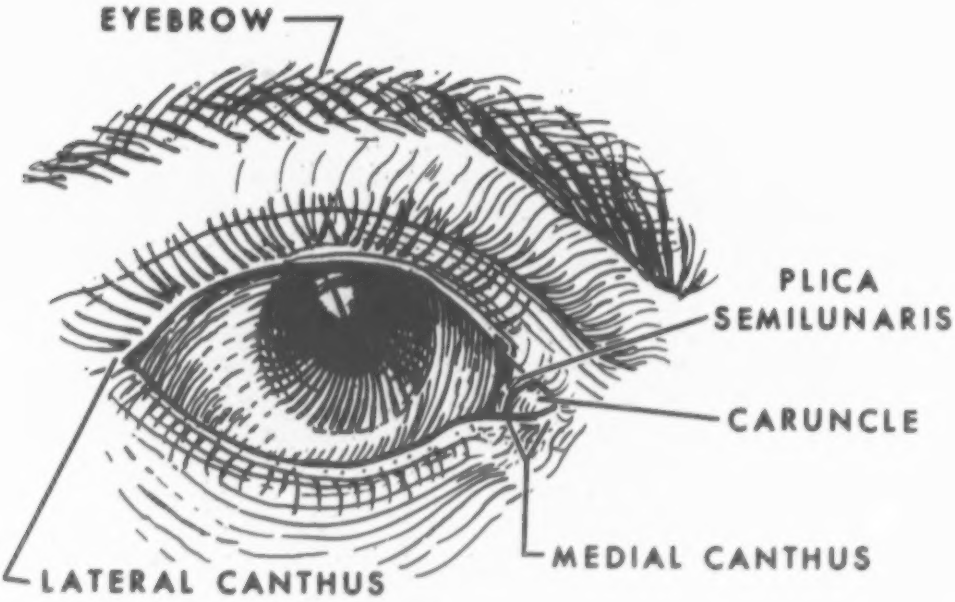

Figure 1-1. External landmarks of the eye.

globe of the eye, and (3) the fornix, the area where the palpebral conjunctiva bends and becomes bulbar conjunctiva (see fig. 1-2). As you can see, the conjunctiva is a continuous layer of tissue. To simplify our discussion, we will use the general term. Conjunctiva forms a barrier against bacteria, as does the skin. In addition, it has a generous blood supply that fights infections. Conjunctiva also contributes cells to the precorneal tear layers.

The Lacrimal System. The lacrimal system is made up of tear-producing glands and a drainage system. Most of the structures in this system are located in, or very near, the eyelids. This system includes the lacrimal glands, lacrimal canals, puncta, canaliculi, lacrimal sac, and nasolacrimal ducts. Figure 1-3 shows the locations of these structures.

How would you like to follow a tear through the system? Let's give it a try.

Your tear begins its journey in the lacrimal gland located in the anterior superior temporal quadrant of the orbit as lacrimal fluid. From there it flows through one of 10 lacrimal canals onto the surface of the eye. Now that wasn't so complicated was it? You say, "Yeah, but what happens next?" Well, a number of things. It mixes with fluid from the accessory tear glands, oils from the meibomian glands and glands of Zeis, and cells from the conjunctiva, and is now a real tear. Some of your tear evaporates—and the cornea eats some of it! Suddenly, a blink starts at the lateral canthus. The eyelids, closing like a Ziploc bag, wipe across the surface of the eye, pick up what remains of your tear, and deposit it in some holes, called puncta, located on the upper and lower lid margins near the medial canthus. Your tear now flows from the puncta through little tubes, called canaliculi, into the lacrimal sac. Finally, your tear drops into the nasolacrimal duct, flows into the back of the throat, and is swallowed. So ends the journey of a tear.

Exercises (200):

1. Draw and label a diagram of the upper eyelid.

2. Define and give the location of each of the following structures:

   a. Lateral canthus.

   b. Medial canthus.

   c. Levator palpebrae superioris.

   d. Lacrimal fluid.

   e. Meibomian glands.

   f. Tarsal plate.

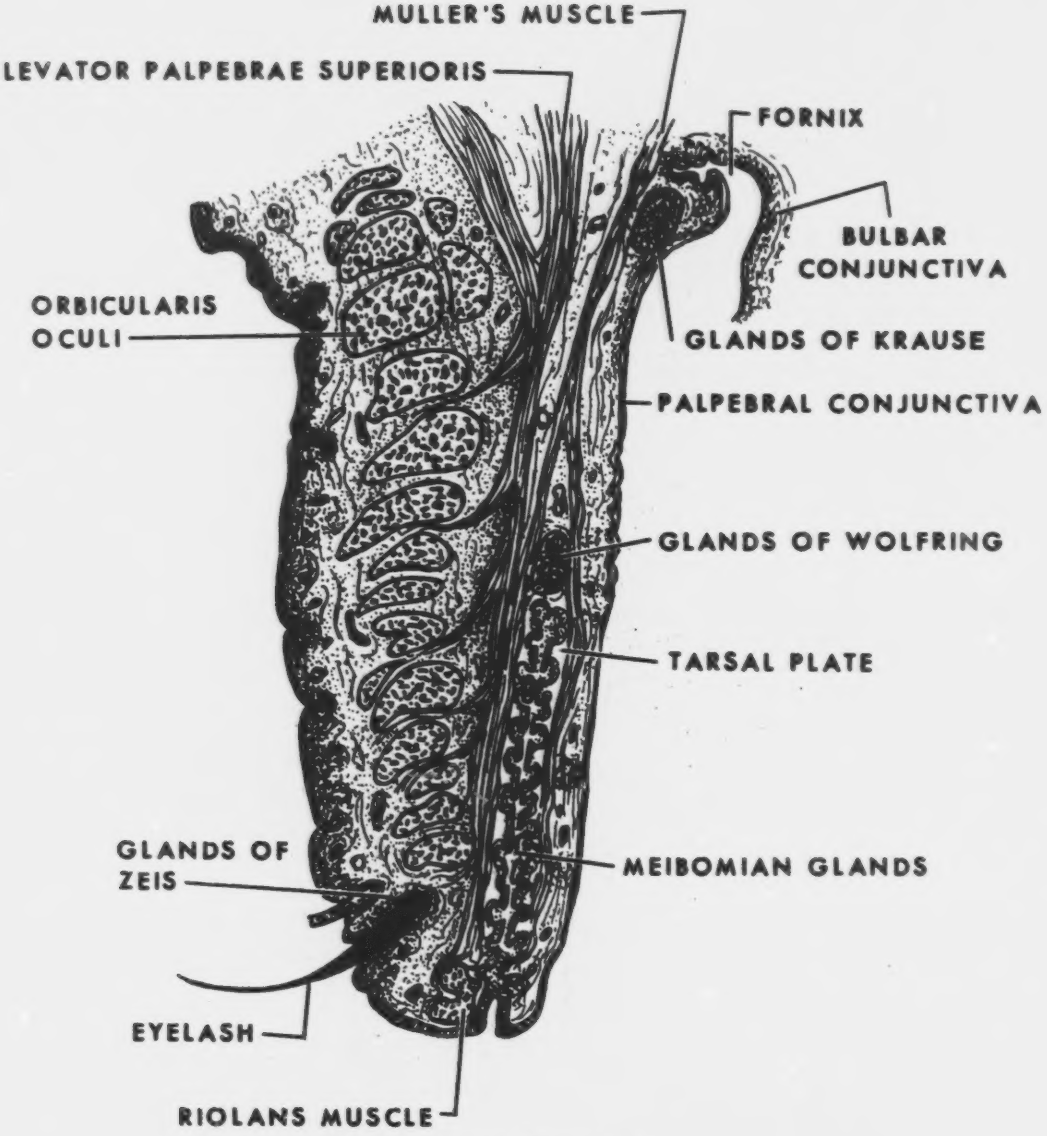
MULLER'S MUSCLE
LEVATOR PALPEBRAE SUPERIORIS
FORNIX
BULBAR CONJUNCTIVA
ORBICULARIS OCULI
GLANDS OF KRAUSE
PALPEBRAL CONJUNCTIVA
GLANDS OF WOLFRING
TARSAL PLATE
GLANDS OF ZEIS
MEIBOMIAN GLANDS
EYELASH
RIOLANS MUSCLE

Figure 1–2. The eyelid.

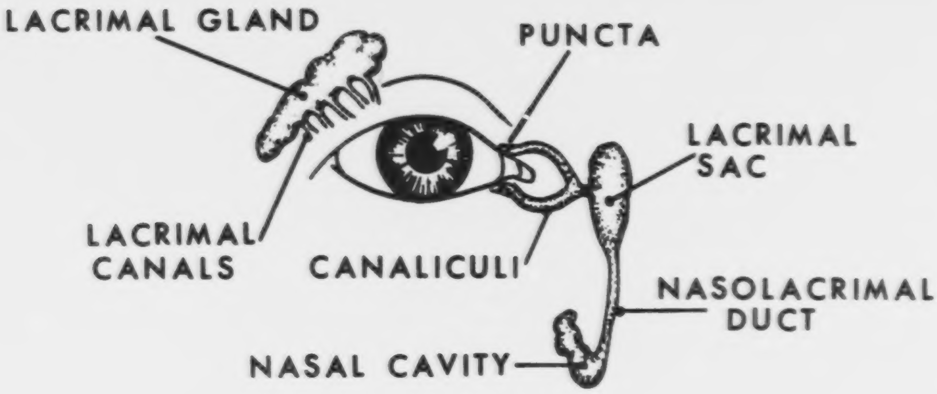

Figure 1–3. The lacrimal system.

g. Orbicularis oculi.

201. Relate the signs and symptoms of external eye conditions to the name most likely to be used by the doctor.

Recognizing External Conditions. So far, we have discussed the anatomy and physiology of the eyelids. Now let's look at some common eye disorders closely related to the eyelids.

Blepharitis. Blepharitis, an inflammation of the lid margins, is one of the most common eye diseases. It is caused by the same conditions that cause dandruff and is usually associated with dandruff. Blepharitis is often easy to recognize because it looks like dandruff on the eyelids and patients complain of itchy eyelids. Blepharitis often causes blepharoconjunctivitis, an inflammation of the lid margin and conjunctiva. The chief complaint in this case is red, burning, itching eyes, and scaly eyelids.

Conjunctivitis. Conjuntivitis, an inflammation of the conjunctiva, is caused by bacteria, viruses, parasites, or just about anything else you can imagine. The chief complaint is usually similar to blepharoconjunctivitis. An important fact you should remember is that serious eye diseases may mimic the signs and symptoms of conjunctivitis. Iritis, an inflammation of the iris, and glaucoma, increased pressure in the eye, are two conditions that may mimic conjunctivitis. Both iritis and glaucoma can cause partial or total blindness. Refer all patients with red, burning, itching eyes to your doctor.

Hordeolum. Internal and external hordeola (sties) are caused by infections in the sebaceous glands. Internal hordeolum is an abscess in the meibomian glands; external hordeolum is an abscess in the glands of Zeis. Both infections cause a painful lump on the eyelid.

Chalazion. Chalazion, also known as meibomian cyst or tarsal cyst, is a condition caused by blockage of a meibomian gland. The gland becomes filled with oil and forms a hard painless lump on the lid. Chalazions may remain as hard painless lumps, enlarge in size and burst, or become infected and burst. Chronic chalazion is usually removed by surgery.

Ptosis. Ptosis is a condition in which the upper eyelid droops. It may affect one lid or both lids and is usually caused by poor innervation of the levator. The usual remedy for this condition is a surgical procedure that shortens the levator.

Exercises (201):

1. What common eye condition does Sleepy, of *Snow White and the Seven Dwarfs*, have?

2. A patient, Airman Sheila Jones, comes into your clinic with the following complaint: "My eyes have been burning and itching for the last few days. I think I have pink eye." What is the medical term used to describe this condition? Explain what you should do for this patient and why.

1-2. Anatomy of the Orbit

So far in our study of ocular anatomy and physiology we have discussed the eyelid and its function. Before we go on to the bony orbit, we should give some attention to another structure closely related to the eye, the eyebrow. Located on the superior orbital margin, the eyebrow consists of a thickened area of skin and numerous hairs. Its primary function is to divert perspiration from the eyes.

202. Draw a diagram of the bony orbit, and label its bones and major openings.

Form of the Orbit. The orbit is a pear-shaped socket that protects the eyeball, ocular blood vessels, and nerves.

The bones surrounding the front opening (aditus orbita) are exceptionally strong and provide most of the protection. Each orbit is wide in front and narrows as it penetrates the skull. The axes of both orbits form an angle of about 45° in the adult. During childhood, the front of each orbit points more temporally. The axes of both orbits form an angle of about 115° and the medial walls are very close together. This explains somewhat the appearance of crossed eyes in many small children.

Each orbit contains 7 bones (fig. 1-4); however, both orbits together contain only 11 bones. Three bones—the ethmoid, sphenoid, and frontal—are unpaired, while the lacrimal, maxillary, palatine, and zygomatic are paired bones.

The roof. The frontal bone forms the anterior portion of the roof, and the lesser wing of the sphenoid forms the posterior portion. These two bones separate the orbit from the anterior cranial fossa.

The medial wall. Starting at the orbital margin and traveling in a posterior direction, the medial wall is composed of the frontal process of the superior maxilla, the lacrimal bone, the ethmoid, and a small part of the sphenoid bone. The medial wall is the weakest wall in the orbit, since the ethmoid bone is paper thin.

The floor. The zygomatic, maxilla, and palatine bones make up the floor of the orbit. The maxilla forms the greatest portion, running from the orbital margin almost to the apex of the orbit. The palatine forms a very small part posterior to the maxilla, while the zygomatic forms the anterolateral portion of the floor.

The lateral wall. The zygomatic forms the anterior portion of this wall and the greater wing of the sphenoid makes up the posterior portion. The lateral portion of the orbit is most exposed to trauma; therefore, the zygoma is the strongest and thickest bone in the orbit.

Openings of the Orbit. There are numerous openings

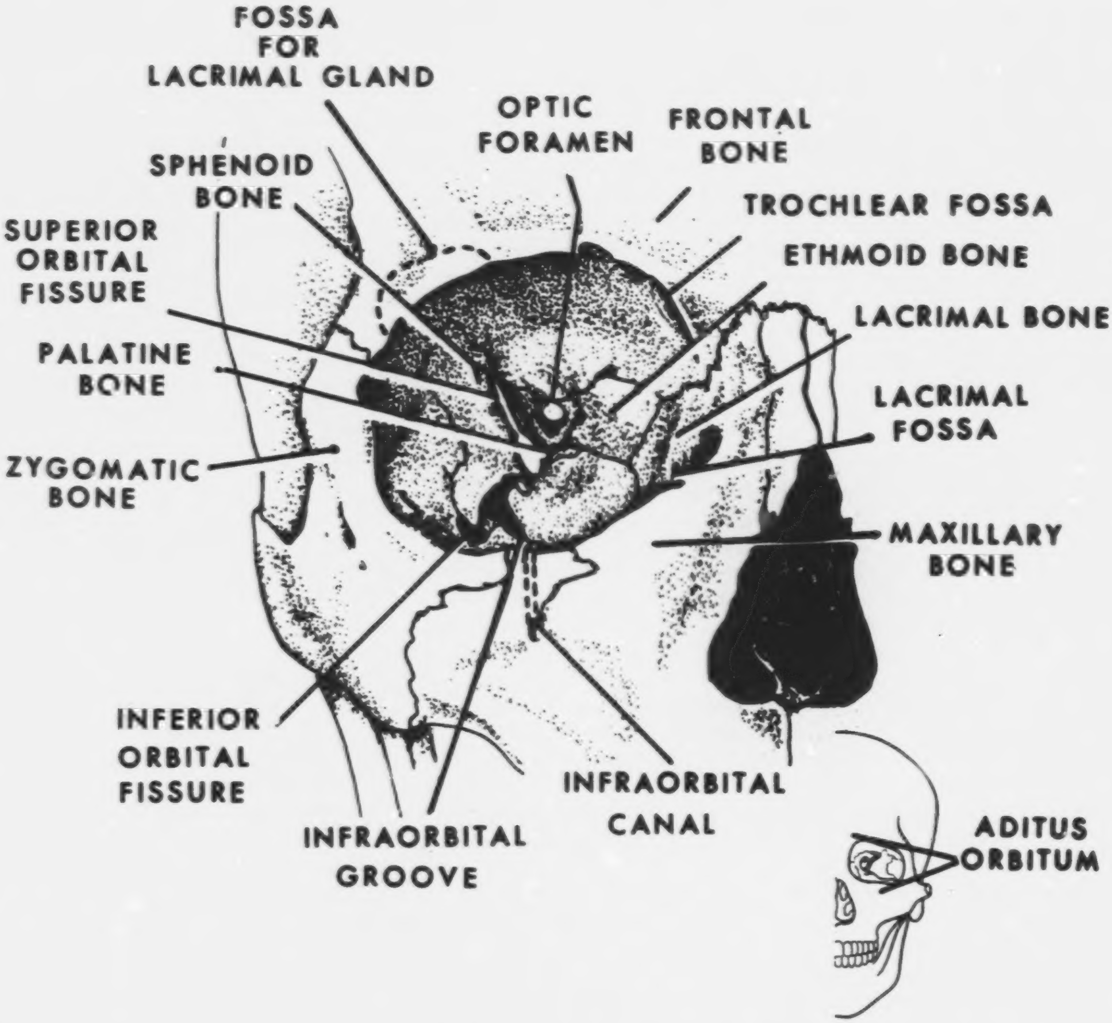
FOSSA FOR LACRIMAL GLAND
OPTIC FORAMEN
FRONTAL BONE
SPHENOID BONE
TROCHLEAR FOSSA
SUPERIOR ORBITAL FISSURE
ETHMOID BONE
LACRIMAL BONE
PALATINE BONE
LACRIMAL FOSSA
ZYGOMATIC BONE
MAXILLARY BONE
INFERIOR ORBITAL FISSURE
INFRAORBITAL CANAL
INFRAORBITAL GROOVE
ADITUS ORBITUM

Figure 1-4. The bones and openings of the orbit.

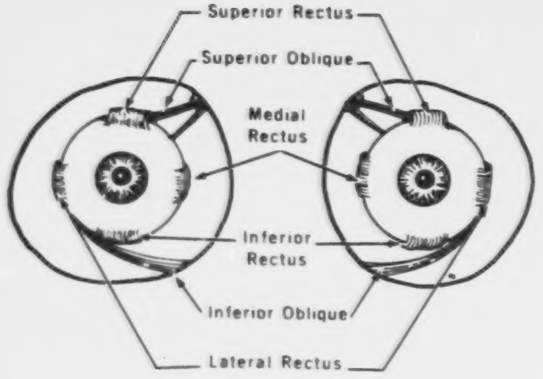

Figure 1-5. The extraocular muscles.

that allow blood vessels and nerves to enter and leave the orbit. These openings are called fissures (cracks) and foramina (holes). We will begin at the posterior pole (apex) of the orbit and identify each of these openings as we travel forward.

Optic foramen. The optic foramen is the hole through which the optic nerve enters the orbit. As the optic nerve enters the orbit, part of the nerve sheath (the dura) spreads out and covers the surface of all the bones in the orbit. This tissue is called periorbita or periosteum and is continuous with the periosteum covering the bones of the face. Periorbita provides a protective sheath for the bones of the orbit.

The superior orbital fissure. The superior orbital fissure is a crack located near the apex. It forms an opening between the greater and lesser wings of the sphenoid. The superior or orbital fissure transmits nerves and blood vessels to and from the orbit.

The infraorbital groove. The infraorbital groove starts beneath and temporal to the apex and travels forward almost to the orbital margin. Its anterior portion is covered by the maxilla and is called the infraorbital canal.

The infraorbital canal. The infraorbital canal opens on the anterior surface of the maxilla about 5 millimeters below the orbital margin. This opening is called the infraorbital foramen. The facial and maxillary nerves leave the orbit through this hole.

The inferior orbital fissure. The inferior orbital fissure separates the lateral wall and the floor of the orbit. This crack starts near the apex of the orbit and follows the same path forward as does the infraorbital groove. The anterior portion separates from the infraorbital groove, continues forward along the lateral wall, and ends about 2 cm from the front of the orbit.

The aditus orbitum. The aditus orbitum is the largest opening in the orbit. This opening is in the front of the orbit and is bound by the frontal bone on top, the lacrimal bone medially, the maxilla on the bottom, and the zygoma laterally. The aditus orbita is the doorway to the orbit.

Each orbit also has a number of depressions that incorporate some important structures.

The lacrimal fossa. The lacrimal fossa is located in the lacrimal bone. It contains the lacrimal sac and nasolacrimal duct.

The fossa. The fossa for the lacrimal gland is hidden behind the orbital rim at the superior and temporal portion of the frontal bone. This fossa contains part of the lacrimal gland and is located better by feel than by sight. It forms a very shallow depression.

The trochlear fossa. The trochlear fossa is located in the superior nasal portion of the frontal bone a few millimeters behind the orbital margin. This depression contains the trochlear pulley. We will discuss this structure as we examine the extraocular muscles in the next objective.

Exercises (202):

1. Draw a diagram of the orbit and label the bones and major openings.

2. Indicate on your diagram the approximate location of the trochlear fossa, lacrimal fossa, and fossa of the lacrimal gland.

203. Identify the point of origin, point of insertion, and nerve innervation of each extraocular muscle.

The Extraocular Muscles. The extraocular muscles are the muscles that move the eyeball. Each orbit contains six of these muscles. This section is designed only to identify the points of origin and insertion. The actions of the extraocular muscles are covered later in this chapter.

Annulus of Zinn. The annulus of Zinn is a circular tendon composed of periorbita attached at the optic foramen. This tendon forms a fibrous cone around the optic nerve and is the point of origin for five of the six extraocular muscles.

The rectus muscles. Each eye has four rectus muscles (refer to fig. 1-5). They are superior, inferior, medial, and lateral rectus. All four of these muscles originate at the annulus of Zinn. The name of each muscle gives you a clue to its point of insertion on the eyeball. The superior rectus (SR) inserts on the superior portion of the sclera near the limbus. The inferior rectus (IR) inserts on the inferior portion of the sclera, the medial rectus (MR) on the medial portion of the sclera, and the lateral rectus (LR) on the lateral portion of the sclera. All of these muscles insert within 4 to 6 mm of the limbus.

The oblique muscles. There are two oblique muscles in each orbit: the superior oblique (SO) and the inferior oblique (IO). The superior oblique originates in the annulus of Zinn, just above and medial to the optic foramen. It travels forward and becomes a tendon near the trochlear pulley. (The pulley is a U-shaped tendon located in the trochlear fossa.) After passing through the trochlear pulley, the superior oblique becomes a muscle again. It now travels across the orbit to the eyeball, passes under the superior rectus, and attaches on the lateral portion of the sclera just behind the equator of the globe.

The inferior oblique is the only muscle that doesn't originate at the annulus of Zinn. It originates on the anterior medial floor near the orbital margin. This muscle traverses the orbit laterally, passes between the inferior rectus and sclera, and attaches to the posterior and temporal portion of the eyeball.

Nerve Innervation. Three nerves innervate the extraocular muscles: (1) the oculomotor, (2) the abducens, and (3) the trochlear nerve.

The oculomotor (third cranial nerve. The oculomotor nerve divides just before it enters the orbit. The superior and inferior divisions then enter the orbit via the superior orbital fissure. The small superior division innervates the superior rectus muscle. The larger inferior division supplies the medial rectus, inferior rectus, and inferior oblique muscles. Therefore, we can safely say that the third cranial nerve innervates the superior rectus, inferior rectus, medial rectus, and inferior oblique muscles.

The abducens (sixth cranial) nerve. The abducens nerve enters the orbit at the superior orbital fissure. This nerve innervates just one muscle, the lateral rectus.

The trochlear (fourth cranial) nerve. The trochlear nerve also enters the orbit via the superior orbital fissure and innervates only one muscle, the superior oblique.

You will find, if you look closely, that each nerve and each muscle or group of muscles have something in common. This commonality will help you remember which nerve innervates which muscle(s). Ask yourself, "What muscle passes through the trochlear pulley?" The superior oblique, right? The trochlear or fourth cranial nerve innervates this muscle. You should remember that the trochlear pulley and troclear nerve correlate with the superior oblique muscle.

Let's try another one. Which direction will the lateral rectus turn the eye? Outward' What is the common term for this movement? Abduct! Now, let's apply this information to a nerve. The *abducens*, or sixth cranial nerve, innervates the lateral rectus. The lateral rectus *abducts* the eyeball. See the relationship?

We have one nerve left, the oculomotor or third cranial nerve. And this one is quite simple: it innervates all the rest of the extraocular muscles. An easy way to remember this is to use the formula $(SO_4LR_6)3$.

Exercises (203):

1. How many muscles move each eye?

2. Which muscle does not originate at the annulus of Zinn?

3. Where does the annulus of Zinn originate?

4. What muscles originate at the annulus of Zinn?

5. The rectus muscles all insert within how many mm of the limbus?

6. The SO passes through the trochlear pulley and then attaches to what portion of the sclera?

7. Which nerves innervate the extraocular muscles?

8. The oculomotor innervates which four muscles?

9. What does the trochlear nerve innervate?

10. Identify the eye muscles shown in figure 1-6 by writing the name of each extraocular muscle in the space provided on the figure.

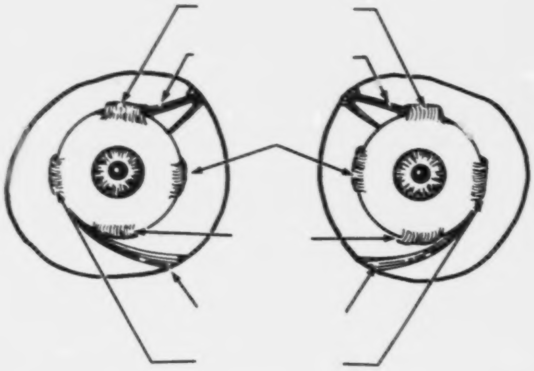

Figure 1-6. The extraocular muscles (objective 203, exercise 10).

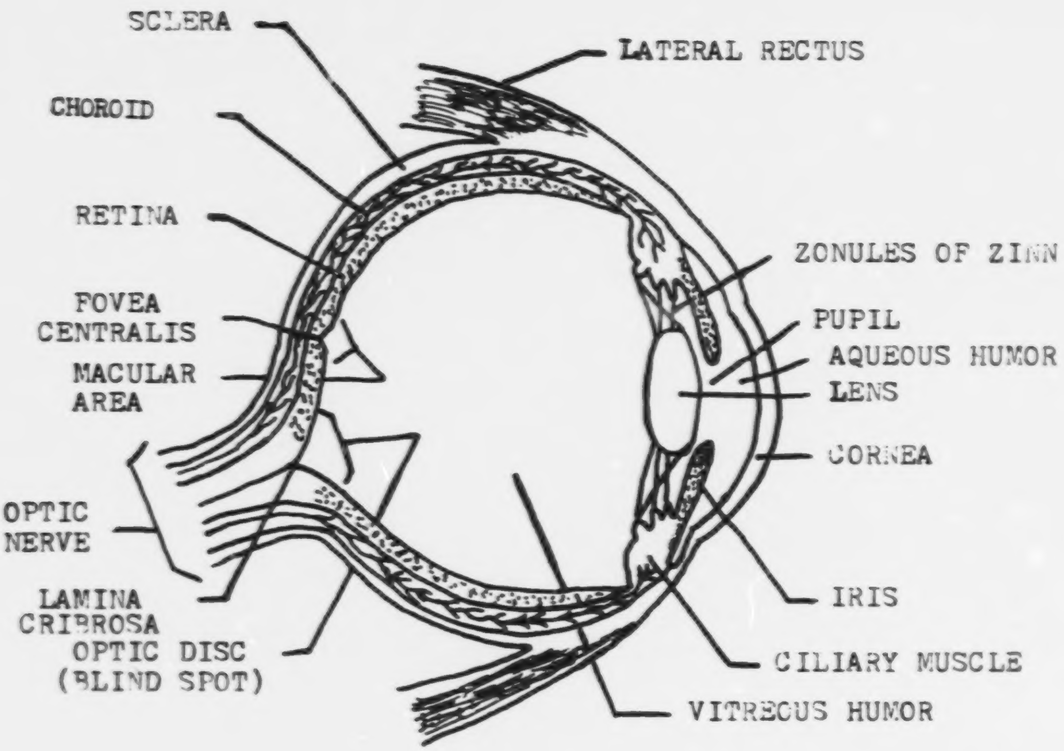
SCLERA
LATERAL RECTUS
CHOROID
RETINA
ZONULES OF ZINN
FOVEA CENTRALIS
PUPIL
AQUEOUS HUMOR
MACULAR AREA
LENS
CORNEA
OPTIC NERVE
IRIS
LAMINA CRIBROSA
OPTIC DISC (BLIND SPOT)
CILIARY MUSCLE
VITREOUS HUMOR

Figure 1-7. The eye (top view).

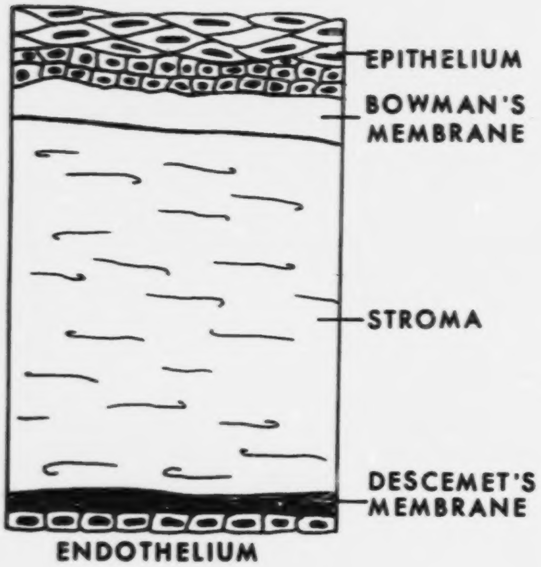
EPITHELIUM
BOWMAN'S MEMBRANE
STROMA
DESCEMET'S MEMBRANE
ENDOTHELIUM

Figure 1-8. Layers of the cornea.

1-3. Anatomy of the Eye

The eyeball lies in the bony orbit and is surrounded by orbital fat, muscles, blood vessels, and nerves. It is about 1 inch in diameter, and contains specialized structures that focus light rays and convert visible light to visual electrochemical impulses, and consists of three coats or tunics (refer to fig. 1-7).

204. Label given diagrams of the human eyeball.

The Cornea and Sclera. The cornea and sclera form the outermost coat or layer of the eyeball. This fibrous coat gives the eyeball its shape.

Cornea. The cornea makes up the anterior one-sixth of the fibrous coat and is the window of the eye. It is about 12 mm in diameter and, since it has about 48 diopters of power, is the most powerful light refracting structure in the eye. The cornea is avascular (contains no blood vessels), is innervated by the 5th cranial (trigeminal) nerve, and is one of the most pain-sensitive tissues in the human body.

The cornea can be divided into five distinct layers. (Refer to fig. 1-8.) The outermost layer, corneal epithelium, is continuous with bulbar conjunctiva and is only five cell layers thick. Corneal epithelium replaces itself very rapidly when injured; no scar tissue forms in this layer. The second layer, Bowman's membrane, is a thin layer of tissue that separates corneal epithelium from the stroma. Scar tissue forms whenever an infection or a foreign body penetrates Bowman's membrane. The third layer, stroma or substantia propria, forms about 90 percent of the cornea. The fourth layer, Descemet's membrane, is a thin layer of tissue similar to Bowman's membrane. Descemet's membrane separates stroma from the innermost layer, the corneal endothelium. Corneal endothelium is one cell layer thick and is in direct contact with aqueous humor (fluid in the front part of the eye). Corneal tissue receives its nutrition from the aqueous humor and the tear layer. Do you recall when you followed a tear through the lacrimal system and the cornea consumed some of that tear?

As you look at the front of a human eye, you see that the center portion is colored and the outer portion is white. Now, if you look closely at the point where color ends and white begins, you see a fine bluish, grayish line. That line, the limbus, is an area of transition from cornea to sclera.

The sclera. Sclera, the white part of the eye, forms the posterior five-sixths of the outermost coat. Sclera is tough, flexible tissue and is the insertion point for the six extraocular muscles. It is thickest at its posterior portion and becomes thinner anteriorly. The optic nerve penetrates the sclera slightly above, and nasal to, the optical axis of the eye (fig.1-7). This area, the lamina cribrosa, consists of many small holes through which the optic nerve passes and is the weakest point in the eye. We will discuss this point in more detail in Volume 4, Chapter 1, when we identify glaucoma. In addition to the optic nerve, portions of the oculomotor (3rd cranial) nerve and various arteries and veins penetrate the sclera.

The ciliary branches of the oculomotor nerve innervate the iris and ciliary muscle (we will discuss these two structures later in this objective); the arteries and veins form a major portion of the vascular tunic.

The Vascular Tunic. The vascular tunic, commonly referred to as the uveal tract, is the middle coat of the eye. This tunic contains three subdivisions: (1) the choroid, (2) the ciliary muscle, and (3) the iris.

The choroid. The choroid forms the posterior four-sixths of the uveal tract. This portion of the tract contains pigment cells which absorb light that penetrates the sclera and a vascular system for most of the structures inside the eye. The primary function of the choroid is to supply blood to the outermost layer of the retina. In addition, it supplies blood to the sclera, ciliary muscle, and iris. The choroid attaches firmly to the sclera at the optic nerve and ora serrata (the jagged line formed by the anterior border of the retina).

The ciliary muscle. The ciliary muscle or ciliary body originates at the ora serrata and attaches to the sclera. (Refer to fig. 1- 9.) This triangular-shaped muscle contains circular (sphincter) muscle fibers and longitudinal muscle fibers. It is responsible for our ability to focus on near objects (accommodation). We will discuss accommodation in Chapter 2 of this volume.

The iris. The iris, the most anterior portion of the vascular tunic, is continuous with the ciliary body. It contains circular and longitudinal muscle fibers and regulates the amount of light entering the eye. It also contains pigment cells and forms the colored part of the eye. An individual who has blue eyes actually has blue irises. The pupil is a hole in the center of the iris through which light passes. The pupil has no anatomical structure—it is like the hole in a donut.

The Nervous Tunic. The retina forms the innermost coat of the eyeball and is a direct extension of the brain and optic nerve. It is firmly attached to the globe at the optic disc and at the ora serrata. This tunic contains the light receptors, and its primary function is to convert light to electrochemical energy and transmit the electrochemical impulses which later become visual sensations. Anatomically, the retina is made up of 10 layers, is about 0.1 mm thick at the ora serrata, and is about 0.25 mm thick at the optic disc.

The rods and cones. The retina contains two types of receptors: rods and cones. Most of the rods are located in the peripheral retina outside the macula lutea. The macula (see fig. 1-7) lies on the optical axis of the eye and is comprised of a central depression about 2 mm in diameter. This depression, the fovea centralis, contains only cones, and is the area of most acute vision. The functions of rods and cones are discussed in more detail in Chapter 2 of this volume.

Layers of the retina. As light strikes the retina, it must pass through several layers of tissue before it reaches rods and cones. Contrary to popular belief, the rods and cones do not point toward the inner portion of the eye, but toward the sclera, and are covered by bipolar cells, ganglion cells, and the axons of the retina (refer to fig. 1-10). The retina may be further broken down into areas of sensitivity that directly relate to specific points in the brain. This "mapping" of the retina is covered in Volume 4.

Blood supply. The retina receives its blood supply from two separate sources. The central retinal artery and vein form the vascular system for most of the retina. These vessels enter and leave the eye at the optic disc. The outermost layer of retina, the rods and the cones, are avascular and are nourished by the choriocapillaris (the innermost layer of the choroid).

The Ocular Media. The ocular media consists of three separate parts. We will discuss each of these parts starting with the anterior portion of the eye.

The aqueous humor. Aqueous humor is a clear, watery fluid that fills the anterior and posterior chambers of the eye. Fluid from vessels in the ciliary process (fig. 1-9) passes into the posterior chamber. From there aqueous flows through the pupil, into the anterior chamber, and is drained off via the trabecular meshwork and the canal of Schlemm. Aqueous production and outflow is a continuous process and regulates pressure within the eye. In addition, aqueous provides nutriment to the cornea and crystalline lens, and serves as a refractive media in the anterior chamber.

The crystalline lens. The crystalline lens (fig. 1-9) lies directly behind the iris. This lens is about 10 mm in diameter and has an inherent power of about +10 to +12 diopters. It is a biconvex lens with a greater radius of

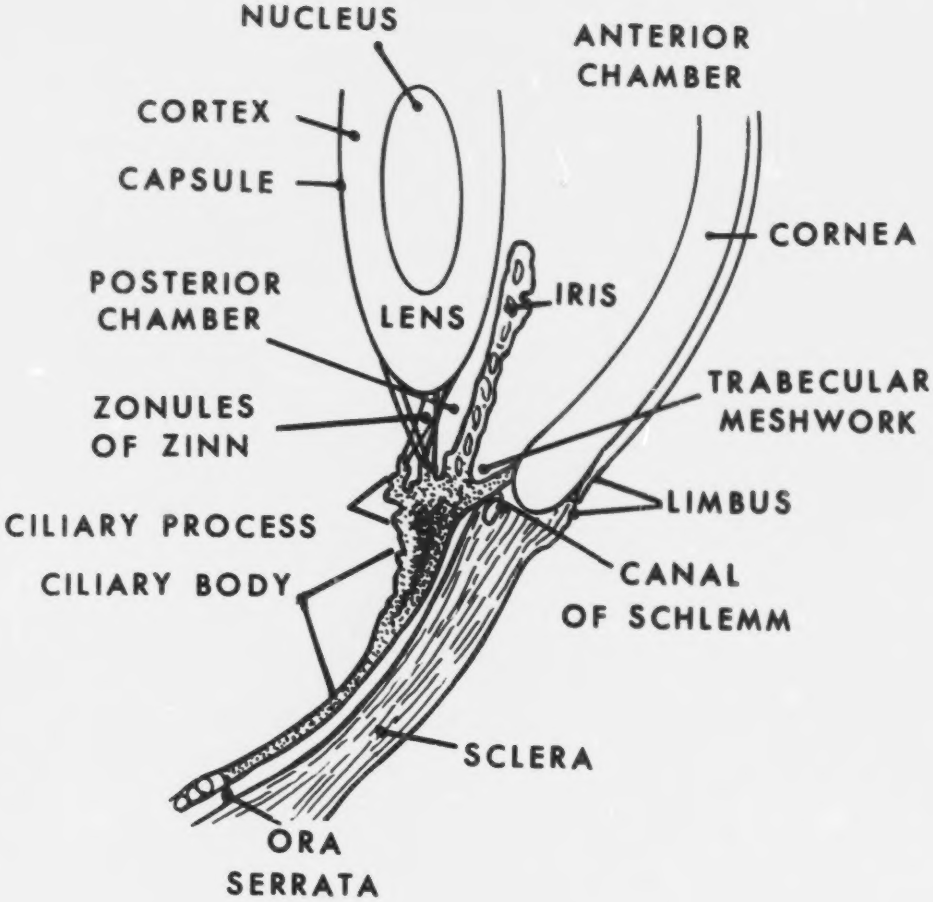
NUCLEUS
ANTERIOR CHAMBER
CORTEX
CAPSULE
CORNEA
POSTERIOR CHAMBER
LENS
IRIS
TRABECULAR MESHWORK
ZONULES OF ZINN
LIMBUS
CILIARY PROCESS
CILIARY BODY
CANAL OF SCHLEMM
SCLERA
ORA SERRATA

Figure 1–9. Anterior segment of the eye.

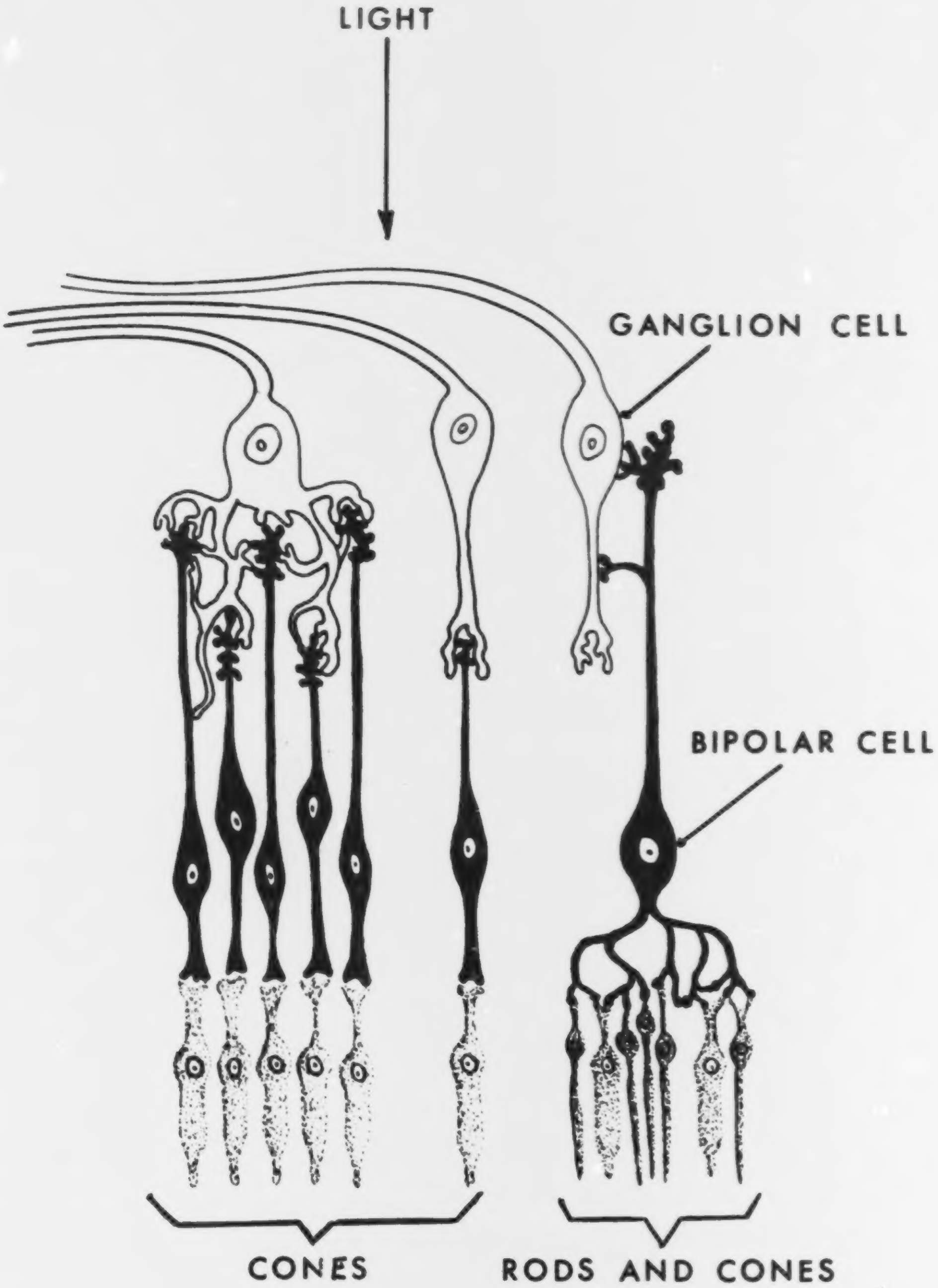
LIGHT
GANGLION CELL
BIPOLAR CELL
CONES
RODS AND CONES

Figure 1–10. Receptors in the retina.

curvature on the front surface. A number of fine fibers, the zonules of Zinn, connect the crystalline lens to the ciliary body. When the sphincter muscle contracts, tension on the zonules relaxes, the lens get fatter, it becomes more convex, and in young people, the power of the lens increases as much as +14 diopters. This flexibility decreases with age so that by age 70 your lens increases its power to only +0.25 diopters. The lens consists of three portions. The lens capsule is the outermost layer and is especially thickened around its periphery where the zonules of Zinn attach. Located within this transparent envelope are the cortex, a gelatinous mass, which in turn surrounds the nucleus, a very thick material with the consistency of a jelly bean. The sole purpose of the lens is to "fine focus" light rays on the fovea centralis. It has no blood or nerve supply.

The vitreous humor. The vitreous humor (fig. 1-7), or vitreous body, fills the entire posterior portion of the eye. Vitreous, a fairly thick gelatinous mass, provides internal support and helps the eyeball maintain its shape. It is avascular like the aqueous, but unlike aqueous, vitreous does not regenerate or reproduce itself. Consequently, many times during perforating injuries to the globe, vitreous escapes, the eye collapses, and the entire eyeball must be surgically removed.

Exercises (204):

1. Identify the anatomical structures in figures 1-11, 1-12, and 1-13 by writing the name of each structure in the space provided.

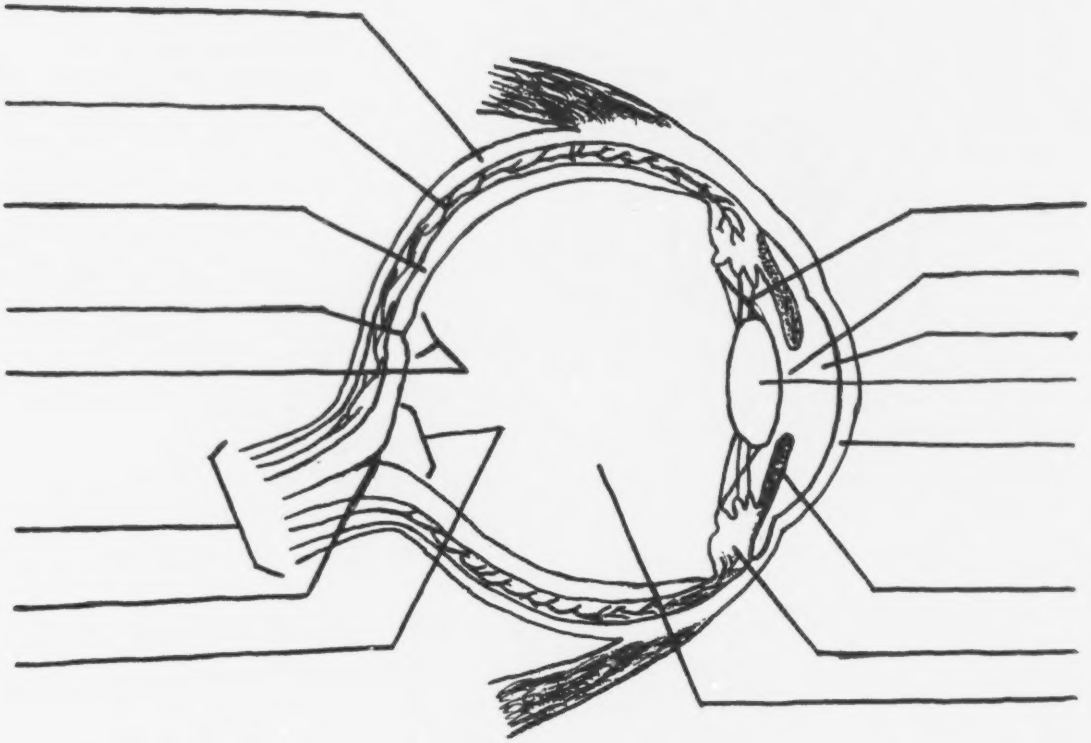

Figure 1–11. The eye (objective 204, exercise 1, top view).

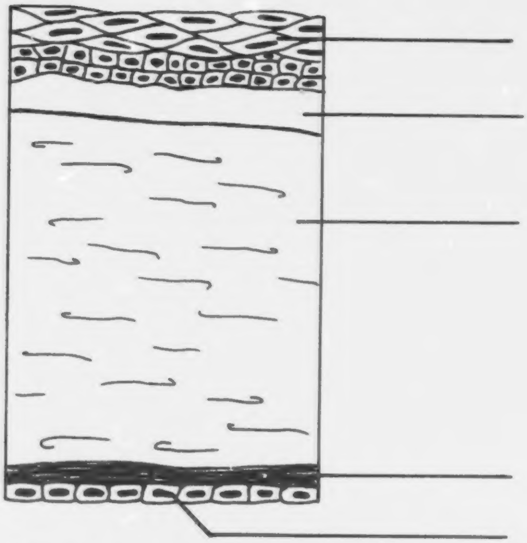

Figure 1–12. Layers of the cornea (objective 204, exercise 2).

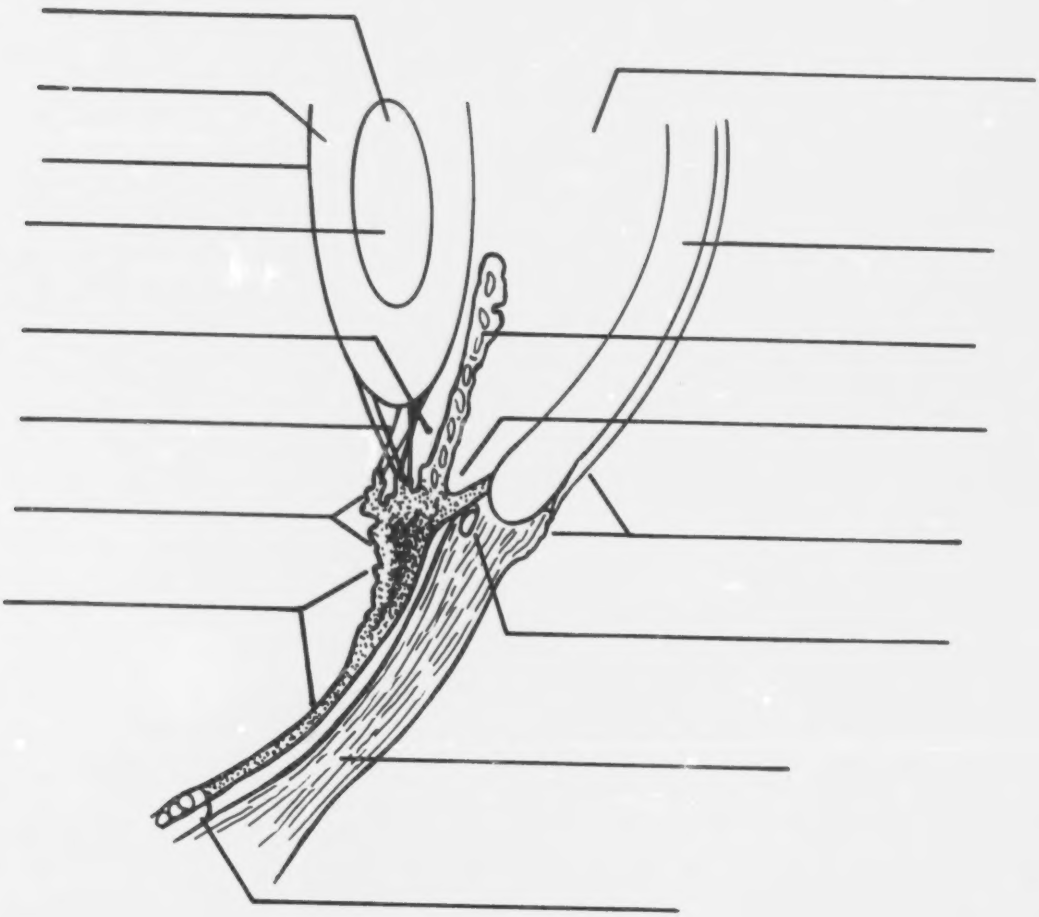

Figure 1–13. Anterior segment of the eye (objective 204, exercise 3).

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1-4. Recording Preexamination Data

Before administering any tests to a patient, certain data is essential to: (1) identify the patient, and (2) indicate which procedures will be used in the exam.

205. For stated purposes, identify the preexamination data and background information that should be entered on a form used to record treatment.

Identification Data. In addition to identification data found on the cover of the medical record folder, each item placed in the folder must be identified properly with *at least* the date of treatment, patient's name, SSAN (or SSAN of sponsor), and examiner's name, rank, SSAN, AFSC (or position), and signature. Additional information as to age of patient and sponsor's name, organization, rank, and duty phone should also be included. Any treatment recorded on a form other than the SF 600, Health Record—Chronological Record of Medical Care, must be annotated on the SF 600 and reference made to the other form.

Patient's Complaint. You are now ready to start asking the patients questions about why they came to the clinic. You want to determine their chief complaint. You may ask, "How do your eyes bother you?" or "What problems are you having with your eyes?" or any similar question in your own words that will get the patient to tell what is wrong. There are two ways in which you can record this information: (1) you can either write the patient's complaint verbatim, or (2) you can condense a longer complaint into a few words. If you do the latter, you should verify your summary with the patient. A good idea is to wait until the patient has finished and then say something like, "Now let's see if I understand your problem correctly. You have blurry vision in your right eye when reading books, and your left eye hurts when you watch TV." It is not necessary to get too detailed a complaint since your optometrist will expand each item during the examination, but make sure that you do mention all of the patient's complaints. Record the complaint in the appropriate space on the examination form, insuring that you leave enough space for the optometrist to make notes.

Ocular History. The next item of concern is the patient's personal and familiar ocular history. Pertinent questions to ask would be:

a. What is your age?

b. Do you wear glasses? How long have you worn them? Are they for distance or near work?

c. How old is your present pair of glasses? When was your last examination?

d. Do you have any personal history of eye disease or injury? If so, please explain.

e. Have you ever had an eye operation? Explain (give date and type of operation).

f. Has any member of your immediate family (blood relatives) had any serious eye problem? Explain.

g. Are you under treatment for any medical condition? Explain.

h. Are you taking any medications? Specify.

i. If the chief complaint concerned headaches, ask, "What area of the head is affected? When do the headaches start, and are they associated with any particular activity?"

These are most of the questions that you should ask each and every patient. Proper questioning technique is a matter of experience and will improve with time. Remember not to insult the patient, spend too much time on insignificant points, or gloss over important items.

Neutralization of Glasses. The next step is to neutralize the patient's glasses, writing the prescription in the appropriate space. Most optometrists want the prescription neutralized in minus cylinder form. Don't forget to note any prism, tint, bifocal add, or special consideration that you might have found. If you note a significant deviation from the prescription as recorded on a previous exam form, bring it to the attention of the optometrist. Spectacle neutralization is reviewed in Volume 3.

After recording the preliminary data, seat the patient in the examination chair. Don't forget to tell the patient if you are going to make any adjustments to the chair. You are now ready to start testing the patient.

Exercises (205):

1. What is the minimum identification data required on each patient?

2. What additional pertinent information data would be helpful and should be included on an eye examination form?

3. What identification data is needed about the examiner?

4. After recording the identification data in the patient's medical record, what two types of questions should you then ask?

5. What is the final preliminary step you take before seating the patient in the examination chair?

1-5. Visual Physiology and Vision Screening Tests

The optometry clinic has the capability to perform many types of examinations, depending on the patient's complaint and the results of preliminary tests. Preliminary test procedures should include, but not be limited to, the following:

- Visual acuities, distant and near.
- Muscle balance tests, distant and near.
- Pupillary reflex tests.

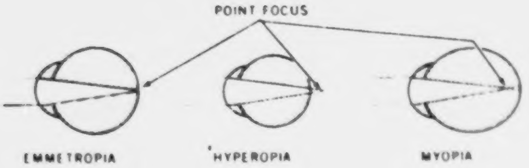


Figure 1–14. Refractive states of the eye.

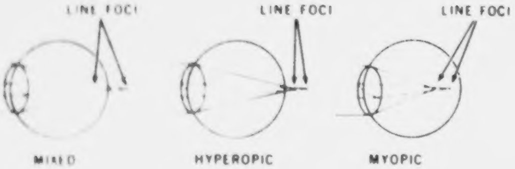


Figure 1–16. The astigmias.

206. Given a list of terms related to visual acuity and a list of descriptive statements, relate each term to its correct description.

Visual Acuity Determinants. Visual acuity may be defined as "clearness of vision," and is dependent on these factors:

- Sharpness of the retinal focus.
- Sensitivity of the visual receptors.
- Number of visual receptors stimulated.
- Interpretative ability of the brain.

Sharpness of the retinal focus. The sharpness of the retinal focus is influenced by refractive errors, clarity of the transmitting media, contrast, and stimulus values.

a. a. Refractive errors. Refractive errors, or ametropias (as opposed to the emmetropic normal eye, shown in fig. 1-14), may be divided into the following:

(1) Hyperopia (fig. 1-14). This is a condition in which, with the accommodative mechanism (ciliary body) relaxed, light from a source located at infinity (20 feet or more) is refracted (bent) so that it tries to focus at a point *behin*d the retina. It is sometimes called farsightedness.

(2) Myopia (fig. 1-14). In this condition, sometimes referred to as nearsightedness, with the accommodative mechanism relaxed, light from a source located at infinity is refracted so that it focuses at a point *in front of* the retina.

(3) Astigmia. This is a refractive error in which different meridians of the eye have differing refractive powers, causing light to focus in a 3-dimensional figure known as Sturm's conoid (see fig. 1-15). The type of astigmatism is determined by the position of the primary line foci, as shown in figure 1-16. Theoretically, individuals with astigmatism may see a point source of light (such as a star) as anything from a line to a blurry oval to a circle, depending on the vergence of the light striking the retina. The axis (or alignment) of the line or oval depends on the axis of astigmatism, or the relative shape of the cornea. Imagine a crystal ball. Saw a piece off the crystal ball, as shown in figure 1-17. If you shine light through this section of a sphere, you will note a relatively good point focus. You can use it just like a magnifying glass to burn holes in paper with the aid of sunlight. This spherical section is equivalent to a spherical cornea in an eye, and the radii of curvature at its curved surface are equal to each other. Now let's go back to the crystal ball. Heat it up until it is soft, smash it down a little, and let it cool. Now saw off a piece as you did before (fig. 1-18). The resultant section is no longer spherical but has differing radii of curvature and corresponds to a spherocylindrical lens. If you try to focus sunlight with this magnifying glass, the light will appear either as a line or oval corresponding to one or the other of the two major axes of the spherocylinder (imagine the major axes as corresponding to the latitude and longitude of a globe), or it may appear as a blurry circle.

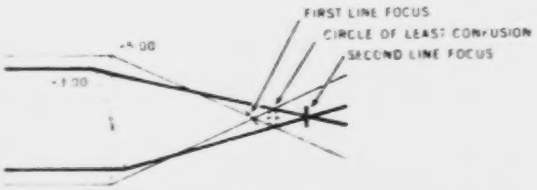


Figure 1–15. Sturm's conoid.

b. Clarity of the transmitting media. Almost everybody knows that you can't see as well on a foggy day as on a clear day, and that it's harder to see through a dirty window than a clear one. These are examples of varying the clarity of the external transmitting media and thereby influencing visual acuity. The media in the eye may also have clouds or opacities in it, thus further influencing vision. A clouding of the lens of the eye is called a cataract. Corneal clouding or scarring has a different name, as does clouding of the vitreous or aqueous chambers of the eye.

c. Contrast. Contrast also affects visual acuity. It is more difficult to see a grey object against a grey backgound than it is to see a black object against a white background. Color may also affect contrast; for example, it is more difficult to see an orange object against a red background than against a blue background.

d. Stimulus values. Stimulus values, or intensity, affect visual acuity. It is more difficult to see at night than in the daytime because of lowered stimulus values (dim light) and also because of a change in the sensitivity of the eye (which will be covered in Chapter 2).

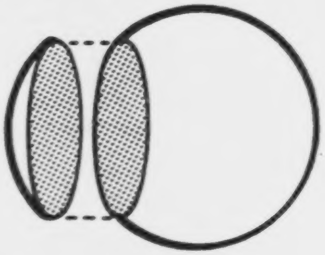


Figure 1–17. Section of a sphere representing a spherical cornea.

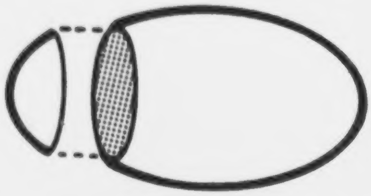


Figure 1-18. Section of a oblate spheroid representing an astigmatic cornea.

Sensitivity of visual receptors. Each retinal receptor (rod or cone), in order to send a signal to the brain, must be stimulated by a certain amount of radiant energy in order to react. Theoretically, a human rod will fire when stimulated by one photon of light energy. Human cones have varying sensitivities but are most sensitive to light with a wavelength of about 555 nanometers. The brightness of light depends mainly on the amplitude of the light wave but is somewhat dependent on its wavelength.

Number of receptors stimulated. The more receptors stimulated, the easier we will see the light, simply because more total energy strikes the retina.

Interpretative ability of the brain. This may be dependent on two factors: (1) duration or exposure, and (2) familiarity with the object. A light must be on for a few milliseconds before we can recognize it, and an object with which we are familiar is more easily recognized than one with which we are unfamiliar.

Exercises (206):

Check your understanding of the factors that affect visual acuity by matching the terms in column B with the descriptions in column A. Each column B item may be used once, more than once, or not at all, and each column A item may have more than one correct response.

Column A

______ (1) Clouding of the vitreous or aqueous fluids or of the lens.
______ (2) Depends on duration of exposure and familiarity with the object.
______ (3) Light from a source at 20 feet is bent so that it tries to focus at a point in front of the retina.
______ (4) Refractive error in which different meridians of the eye have different refractive powers.
______ (5) An opacity of the lens.
______ (6) Light from a source at 20 feet is bent so that it tries to focus at a point behind the retina.
______ (7) Varies according to the amplitude of the light wave and also according to its wavelenth.
______ (8) Twenty feet or more.

Column B

a. Astigmatism.
b. Stimulus values.
c. Myopia.
d. Cataract.
e. Contrast.
f. Hyperopia.
g. Farsightedness.
h. Opacities.
i. Sensitivity of visual receptors.
j. Nearsightedness.
k. Ametropias.
l. Infinity (as related to eye examinations).
m. Interpretive ability of the brain.
n. Sturm's conoid.
o. Meridians.
p. Clarity of transmitting media.

Column A

______ (9) Major axes of the eye that correspond to the latitude and longitude of a globe.
______ (10) The difference between an object and its background or between two colors.
______ (11) Way in which light focuses in the presence of astigmatism.
______ (12) Lowered in dim light and elevated in bright light.
______ (13) External influences that affect visual acuity, such as fog or a dirty window.
______ (14) Refractive errors.

207. Interpret specific patient scores on the standard clinical visual acuity (VA) test, and indicate procedure and interpretation when testing patients for whom the VA is unobtainable on a standard chart.

Clinical Visual Acuity Test Scoring. These tests are designed to keep all factors constant except size (number of receptors stimulated). Clinical tests are based on the smallest recognizable object (usually a familiar letter) seen correctly at a specific distance under constant illumination. Routine visual acuity tests in an eye clinic are usually *form vision tests*. Form vision includes detection, discrimination, and recognition of the letter or object being used as a test target. Sometimes the clinical test is called minimum visual angle, because it is measured by noting the angular separation (in minutes) of the components of the test letter or pattern. The reciprocal of this angle indicates the routine VA (visual acuity) measurement.

Standard format for recording visual acuity. Clinical visual acuity is recorded in the form: 20/X where 20 is the test distance in feet, and X represents the smallest line that the patient can read. 20/20 means that the patient can read the 20 foot letter at a distance of 20 feet. The fraction 20/20 may be reduced to the whole number 1. The 20-foot letter subtends 5 minutes (5′) of arc at the eye, and all letters are assumed to have five components (as shown in figure 1-19). Therefore, if the letter is divided into its components, each *component* subtends 1 minute (1′) of the arc. 20/20 = 1 = 1 minute of arc. 20/20 then can also mean that the eye can discriminate a figure composed of elements no smaller than 1 minute of arc.

If the patient has poorer than average VA, 20/40 for example, they can read the 40-foot letter at 20 feet, or in other words, they see at 20 feet what an individual with 20/20 vision sees at 40 feet. The reciprocal of 20/40 is 2, and each component of the 20/40 letter subtends 2 minutes of arc at the eye. It is twice as large as the 20/20 letter.

A patient with better than average vision, 20/10 for example, can read the 10-foot letter at 20 feet. They can see at 20 feet what the average person with 20/20 vision sees at 10 feet. The reciprocal of 20/10 is 0.5, and the components of the 20/10 line subtend 0.5 minutes (30 seconds, or 30″) of arc at the eye.

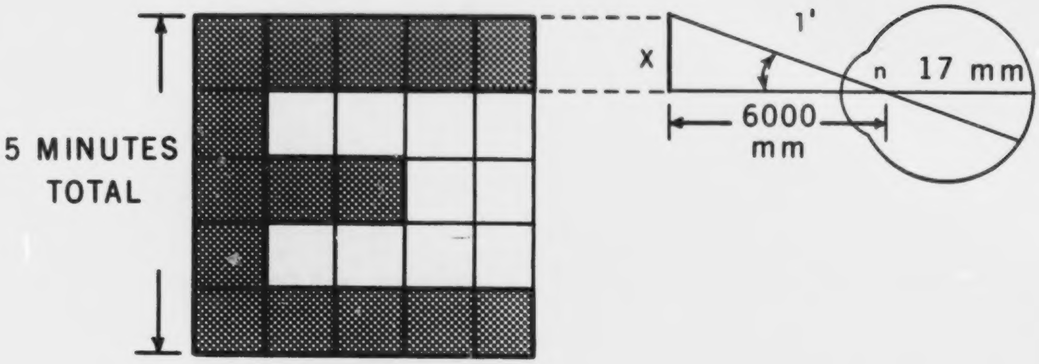


Figure 1-19. The Snellen E.

Sometimes a test distance other than 20 feet is used. For example, if the test distance is 10 feet, special charts are used to compensate for this change, with letters half the size of the standard chart. If the patient can read the average line on this chart, their actual acuity is 10/10, which is equivalent to 20/20 (the reciprocal of each is 1). Visual acuity for far tests are always recorded with 20 as the numerator, even if the test room is less than that distance. If the patient's vision is so bad that they must change the viewing distance in a normal 20-foot room, the acuity is recorded as the viewing distance (numerator) over the test letter size (denominator). For instance, if an amblyopic patient (patient with uncorrectable poor vision) who is tested in your eye lane cannot see the 20/400 "E" on the Snellen chart, have them approach the chart until they can read the letter. Record the patient's acuity as the test distance (numerator) over the test letter (denominator); for example, 8/400.

People who have been examined in Britain or other European countries may have their acuities recorded as 6/6. This means that the test distance was 6 meters, and the patient could read the 6 meter letters. 6/6 is equivalent to 20/20; 6/3 is equivalent to 20/10; and 6/12 is equivalent to 20/40, etc. The U.S. may soon metricate its visual acuity tests in this manner.

Near point acuities may be recorded with 14 as the numerator; this means that the test distance is 14 inches. 14/14 is equivalent to 20/20, 14/7 is equivalent to 20/10, and 14/28 is equivalent to 20/40 at near.

Remember—clinical VA is recorded as the reciprocal of the angular separation of the components of the test letter. All letters are assumed to have five components, as in the blocks drawn in figure 1-19. If the angular separation of these components is 1 minute, the VA may be 14/14, 10/10, 20/20, or 6/6, depending on the test distance.

Patients whose scores are unobtainable on a standard chart. The only time we do not record visual acuities in the standard format is for patients with very poor vision. Assume that a patient could not read the 20/400 letter until he or she is within 5 feet of the letter. You could record the VA as 5/400 or 20/1600, but obviously the guess factor is pretty good for a Snellen "E," and this number won't mean much. If VA is unobtainable on a standard chart, test the patient's vision by asking him or her to correctly count the fingers on your hand. Measure the distance at which they can correctly count the fingers and record as:

F.V. - 12, feet, or
F.V. - 5 feet, or whatever the distance is.

If the patient has problems seeing your fingers, try hand motion and record "HM only" (hand motion only). If there is still a problem, check whether they can see the light of the projector. Shine the light on various areas of the room to see whether or not the patient can locate it. Record as "LL only" (light location only). If the patient cannot correctly locate a light source, turn the room lights on and off to see if the patient can tell whether they are on or off. Record as "LP only" (light perception only).

Amblyopia. Sometimes a patient is found who has healthy eyes but cannot see well. If neither the pinhole nor lenses improve the patient's vision, they are said to be amblyopic. Clinical amblyopia is about 20/30 or worse, uncorrectable, usually in one eye.

Usually amblyopia is associated with strabismus (heterotropia or squint), and may begin with a suppression of the vision of one eye. Suppression is a turning off or ignoring of the vision of one eye while both eyes are open. This may be done to reduce the discomfort of either diplopia caused by strabismus, or blurred vision from some other cause. Suppression is found only when the patient is binocular (has both eyes open); if the good eye is closed, the suppressing eye can see fairly well if the optics are corrected. Amblyopia is a more severe problem—if the good eye is covered, the amblyopic eye still cannot see well, even if the retinal image is sharp.

Exercises (207):

1. Match each test score in column A with the item that interprets it in column B. Each response in column B

will be used more than once, and each column A item will have two correct answers.

Column A

______ (1) 20/40.
______ (2) 20/20.
______ (3) 20/10.
______ (4) 10/10.
______ (5) 6/6.
______ (6) 14/7.
______ (7) 14/28.
______ (8) 14/14.
______ (9) 6/12.

Column B

a. The eye can discriminate a figure with elements subtending 1 minute of arc at the eye.
b. The eye can discriminate a figure with elements subtending 0.5 minute, or 30 seconds, of arc at the eye.
c. The eye can discriminate a figure with elements subtending 2 minutes of arc of the eye.
d. The patient can read the Snellen 20-foot letters at a distance of 20 feet, or its equivalent.
e. The patient can read the Snellen 20-foot test at 40 feet, or its equivalent.
f. The patient can read the Snellen 20-foot letters at a distance of 10 feet, or it equivalent.

2. If the patient cannot see the Snellen 20/400 letter, how should you obtain his or her VA?

3. If the score cannot be obtained by the means just mentioned in exercise 10, what should you do next?

4. What should you do if the patient cannot locate the projector light?

5. If the patient has a VA of 20/30 or worse, uncorrectable, usually in one eye, what are they said to have?

6. If the patient uses only one eye for vision (both eyes open) but can see fairly well with the poor eye when the good eye is covered, what is the condition called?

7. What is the condition called if the patient uses only one eye for vision and still cannot see with the poor eye when the good eye is covered?

208. List the advantages and disadvantages of the eye lane screening tests.

Advantages and Disadvantages of Eye Lane Test. Perhaps the most commonly used instrument for vision screenings is the eye lane. As with any instrument, there are both advantages and disadvantages of its use. This unit will explore the techniques, procedures, and tests used in the eye lane, as well as their advantages and disadvantages. Advantages include:

(1) Highest compatibility with visual analyses tests.

(2) No additional space needed for supplementary equipment.

(3) Good flexibility of test procedures.

Disadvantages include:

(1) Possibility of nonavailability of eye lane at any particular time.

(2) Patients may mistakenly believe that they are receiving a visual analysis instead of a screening.

Exercises (208):

1. What are the advantages and disadvantages of the eye lane test?

209. Specify the visual screening tests that an optometry specialist can and cannot perform, and identify the first test to be given in a visual survey (vision screening).

Scope of a Visual Survey or Vision Screening Test. There is much discussion about the scope of a visual survey (vision screening). Many professionals in the eye care field believe that in addition to the three preliminary test procedures mentioned earlier, all screenings should include an examination for ocular pathology and a retinoscopy to determine presence or absence of an excessive, but compensated, refractive error. The optometry specialist is not qualified to perform either of these tests, although with experience you may recognize abnormalities of the ocular adnexa (appendages of the eye, such as the eyelids, lacrimal apparatus, and extraocular muscles) and properly refer such patients for treatment. Quick tests also exist for determination of excessive refractive errors and amblyopia that do not involve retinoscopy. These tests will be included in this chapter. When performing a screening on a patient for any reason and using any technique, the first test should *always* be a test for visual acuities.

Exercises (209):

1. What two visual screening tests, in addition to those already mentioned, can you, as an optometry specialist, perform?

2. Name two tests that the optometry specialist cannot perform.

3. What should always be the first tests that the optometrists survey?

210. State the procedures used in operating and maintaining the Projectochart, and define terms used in connection with the test.

The Projectochart. One of the most commonly used instruments in the clinic is the American Optical Projectochart (see fig. 1-20) or the Bausch & Lomb equivalent. This instrument is essentially a slide projector with special ophthalmic slides. Screens are supplied with the instrument. Lens tubes may be specially designed for either a 15- to 20-foot room or a 10- to 14-foot room. Replacement bulbs may be ordered through medical supply.

Operation. In order to accurately project a letter of the proper size and dimensions, the Projectochart must be positioned with respect to the screen and patient. Elevation of the projector is accomplished by unlocking the set screws in the base of the stand and adjusting the supporting column. The projector tube should be on the same horizontal plane as the reflective screen. The proper size of the projected letters is assured by calibrating in the following manner:

a. Measure the distance from the screen to the patient's eyes. Adjust the chair, if possible, so that this distance is an even number of feet.

b. Place the Projectochart 3 or 4 feet in front of the patient and a little to one side. Plug the instrument into convenient 115-volt AC outlet. Insert the test slide in top of the instrument, then turn on the instrument.

c. Loosen the knurled ring near the base of the tube so that the objective lens will be allowed to slide in its mount. Adjust the objective lens so that the image of the letters is clear and sharp. Now place the test distance template supplied with the projector against the reflective screen. Adjust the screen-projector distance until the 20/200 E matches the vertical scale for the test distance which you are using. If your test template is missing, the following heights will be sufficiently accurate:

Chair-Screen Distance	*20/200 E Height*
20'	89 mm
15'	66 mm
10'	44 mm

Intermediate heights may be interpolated, or use the chart in Appendix A to calibrate your projector.

d. Readjust the focusing tube and the screen-projector distance so that the proper size image is clear and sharp.

e. Mark the floor near the base of the stand to facilitate repositioning of the projector after moving it for cleaning or repairs.

The horizontal selector device is used to provide either a full square image or a vertical line image. The red-green filters are provided to be used in the Duochrome test. (Due to the chromatic aberration of the eye, a hyperope will see letters in the green clearer than letters in the red. The opposite is true for a myope.) The vertical slide control knob is provided to change projected areas of the slide. The small lever, horizontal line selector, provides a horizontal line of letters or, in conjunction with the vertical line on the selector device, provides viewing of single letters.

Maintenance. Maintenance of the Projectochart is relatively easy. Clean the glass slides and lenses in the focusing tube by wiping them with a soft, dry, clean cloth. Never attempt to remove the lenses from the focusing tube. The lamp is replaced in the following manner: Press the lamp house release button near the top of the lamp house; allow the lamp house section to swing back on its hinges; remove the inner lamp house by pulling the top back toward you until the spring clips have disengaged; then lift out. The lamp has a bayonet socket and may be removed by pressing down, twisting counterclockwise, then lifting out. Do not attempt any further disassemblage. (CAUTION: If the lamp was on prior to removing the bulb, the housing may be extremely hot. Take care not to burn your fingers. Before inserting a new lamp, insure that all fingerprints have been wiped from it; otherwise, the bulb may crack when hot.)

Usually, the right eye is tested first, and the results are recorded immediately after completion of the test. Occasionally, it may be necessary to encourage the patient to continue reading smaller lines. The abbreviations "R" for right eye, or "OD" for the Latin "oculus dexter," may be used in recording results of the test. The left eye is usually tested second, and the results are recorded immediately after the test is completed. The abbreviation "L" for left eye, or "OS" for the Latin "oculus sinister," may be used. If both eyes are tested together after testing the eyes individually, the abbreviation "OU" for "oculus uterque" may be used.

If the patient wears glasses, tests of their visual acuity are normally given first without their glasses and then with their glasses. Screening or survey tests may be given with the "habitual Rx," meaning that the patient takes the test with glasses, if worn.

Two types of examinations are normally given in the eye clinic: a manifest or dry examination or a cycloplegic or wet examination in which the pupils of the eye are artificially dilated. Visual acuities are recorded when the patient is dry for most procedures.

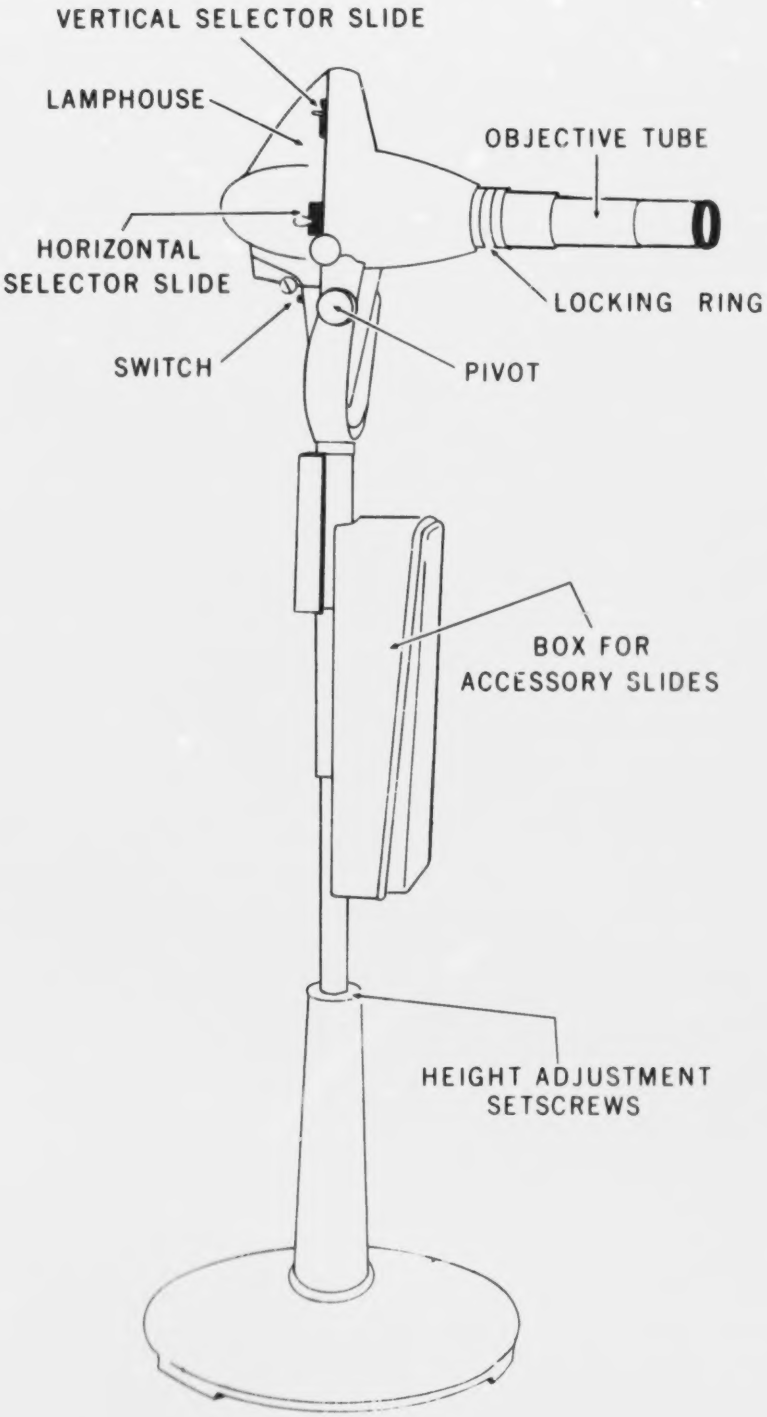

VERTICAL SELECTOR SLIDE
LAMPHOUSE
OBJECTIVE TUBE
HORIZONTAL SELECTOR SLIDE
LOCKING RING
SWITCH
PIVOT
BOX FOR ACCESSORY SLIDES
HEIGHT ADJUSTMENT SETSCREWS

Figure 1-20. The Projectochart (AO).

Exercises (210):

1. How do you adjust the focus on the Projectochart?

2. How do you raise or lower the projector?

3. Why is it important that the screen-projector distance be calibrated?

4. If the test template is missing, what should you do?

5. When it is necessary to move the projector for cleaning or repairs, how can it be easily repositioned?

6. In the Duochrome test, what letters will be clearer to a hyperope; what letters will be clearer to a myope?

7. How can you change projected areas of the slide?

8. How is it possible to view single letters?

9. How do you clean the glass slides and lenses in the focusing tube?

10. Before inserting a new lamp bulb, what precaution must you take?

11. Match each term or abbreviation in column A with its correct meaning in column B. Each column B item may be used once or more than once.

Column A	*Column B*
______ (1) "OS."	a. Left eye.
______ (2) "Dry" examination.	b. Right eye.
______ (3) "L."	c. Examination in which pupil of eye is not dilated.
______ (4) "R."	d. Examination in which pupil of eye is dilated.
______ (5) "Wet" examination.	
______ (6) "OD."	
______ (7) Manifest examination.	
______ (8) Cycloplegic examination.	

211. Identify test procedures for the far point eye lane tests.

Far Point Tests. If the patient is illiterate, or is a child who cannot read letters, use the Tumbling E chart or Landolt C chart. Ask the patient to identify the direction in which the arms of the E or the break in the C points. Children may be asked to point their fingers in the same way that the fingers of the picture point. The test procedure is the same as that stated in objective 207.

If the patient is literate, the Snellen test card or Snellen (or Sloan) Projectochart letters may be used. The Snellen test charts for distant vision contain square-shaped letters that diminish in size from the top line downward. The largest letter, which is on the top line, can be read by a person with normal vision at a distance of 200 feet (some charts have a 400-foot letter). The next lines can be read at 100, 80, 70, 60, 50, 40, 30, 25, 15, and 10 feet, respectively. These distance are noted on the chart opposite each line of letters that can be read at that number of feet by a person with normal vision.

When completing an SF 88, Report of Medical Examination, record vision in the form of a fraction and in round numbers; that is 20/20, 20/40, not 20/20 + 2 or 20/40 − 3. When completing a form used by the optometrist in examinations, the used of a (+) or (−) symbol and the number of any additional letters read or missed is acceptable; therefore, if a patient correctly reads the 20/30 line and 3 letters on the 20/25 line, their acuity would be recorded as 20/30 + 3 for that eye. If a patient correctly reads 75 percent of a line, give them credit on the SF 88 for having successfully read the entire line.

Exercises (211):

Identify each true statement and explain why the others are false.

____ 1. Use the Snellen test card or Snellen or Sloan Projectochart letters for all patients for the far point eye lane tests.
____ 2. In the Tumbling E chart of Landolt C chart, children can be asked to point their fingers in the same way the fingers of the picture point.
____ 3. When completing an SF 88, record the patient's score as 20/40 + 2 or 2080 − 3, for example/
____ 4. When completing a form used by the optometrist, record the patient's score at 20/40 or 20/10, for example.

TABLE 1-1
CONVERSION TABLE FOR VARIOUS NEAR POINT LETTER NOMENCLATURE

Standard Test Chart	Snellen English Linear	Snellen Metric	Jaeger
14/14	20/20 --------	0.50M	J-1
14/17.5	20/25 --------	.62	J-2
14/21	20/30 --------	.75	J-4
14/28	20/40 --------	1.00	J-6
14/35	20/50 --------	1.25	J-8
14/49	20/70 --------	1.75	J-12
14/70	20/100 -------	2.25	J-14
14/140	20/200 --------	----------	------

____ 5. If a patient reads 75 percent of a line of letters correctly, they get credit for having read that line successfully.

212. Identify the requirements covering classes of patients who may and may not wear glasses when taking the near point acuity test, and name the ways of recording near visual acuity.

Near Point Tests. Near visual acuity is determined for each eye separately. For flying Class I and IA examinations, glasses may not be worn. For all other examinations, near vision will be recorded both with and without corrective lenses if glasses are worn or required. Individuals over 40 years of age may wear presbyopic corrections up to +2.50 D sphere when being tested for entries on an SF 88, and may wear any habitual Rx when being tested for a routine eye examination. Correction worn will be noted on the report examination.

Test for near vision using Chart Set, Vision Acuity Testing, Near Vision, at a distance of approximately 14 inches. Instruct the patient to read the smallest print possible.

Record near visual acuity with the numeral 20 at the numerator when completing an SF 88, but when completing the clinical form, use of the numerator 14 is acceptable. See table 1-1 for conversion information for near point cards. Some civilian eye examination forms require near point acuities to be given in Jaeger optotype size.

Exercises (212):

1. What class of patients may not wear glasses when taking the near pont acuity tests?

2. What patients may wear glasses when taking the near point test?

3. List four ways in which near visual acuity may be recorded?

213. Specify characteristics of the pinhole test.

Pinhole Test. The pinhole test is often used to screen for amblyopia or to estimate the BVA (best visual acuity) of the patient. If a patient has poor VA as shown by standard tests, give them the pinhole disc from the trial lens case and instruct them to hold the disc in front of their poor eye while occluding the other eye. If the diminished acuity is due to a refractive error, the patient's acuity will improve significantly with use of the pinhole; if a neurological problem is the cause of the poor VA. no improvement will be found.

If you perform a pinhole test on a patient, record the VA without the pinhole; then record the VA with the pinhole. Write "pinhole" or "PH" after this finding.

The pinhole test workds because the pinhole aperture of the disc allows only a small bundle of light rays to enter the eye—and this bundle must pass through the optics of the eye relatively close to the principal axis of the optical system. Light passing along the principal axis of an optical system is not refracted. Therefore, the pinhole effectively eliminates the dioptrics of the eye and provides a relatively clear retinal image. If the patient is amblyopic or has opacities in the refractive media, acuities taken with a pinhole are equal to or worse than the acuities taken without the pinhole.

Exercises (213):

Identify each true statement and explain why the others are false.

____ 1. The patient hold the pinhole disc in front of the poor eye and occludes the other eye.

____ 2. If the patient's diminished acuity is due to a neurological problem, his or her acuity will improve with use of the pinhole.

____ 3. Record the patient's VA both with and without the pinhole.

____ 4. Light passing along the principal axis of an optical system is refracted/

____ 5. If the patient has opacities in the refractive media, acuities taken with a pinhole are equal to or better than acuities taken without the pinhole.

214. Specify basic procedures for administration and interpretation of the plus lens test.

Plus Lens Test. The plus lens test may be administered in conjunction with any standard far point VA test. This procedure is designed to detect moderate to severe hyperopia in patients who may otherwise compensate enough to pass a survey or screening test. Administer the

TABLE 1–2
RESULTS OF SCREENING TESTS FOR VARIOUS EYE CONDITIONS

	Nonpresbyopic					Presbyopic			
	Emmetrope	Hyperope	Myope	Astigmat	Amblyope	Emmetrope	Hyperope	Myope	Astigmat
Unaided DVA	good	good	poor	poor	poor	good	poor	same as nonpresbyopic patient	
Unaided NVA	good	good	good	poor	poor	poor	poor		
Pinhole VA (20')	N/A	N/A	better	better	no better	N/A	better		
(14")	N/A	N/A	N/A	better	no better	better	better		
Plus Lens Test (20')	passes	fails	N/A	N/A	N/A	passes	fails		
Duochrome Preference	equal	green	red	varies	varies	equal	green		

plus lens test *only* at far point and only on patients who were able to read letters in the vicinity of 20/20.

After recording the VA in the usual manner, place a +1.25 D lens in front of the eye being tested and ask the patient to read the smallest line they can. If VA is still 20/20, the patient *fails* because they are hyperopic at least +1.25 D. *If the patient can no longer read the chart, they pass.* If this test is used in your clinic, record it as "plus lens test - pass" or "plus lens test - fail" on your local form. If the patient fails this test, he or she should be given a complete visual analysis. Table 1-2 shows the expected findings using various tests on patients with and without refractive error.

Exercises (214):

1. What does the plus lens test detect in patients who have passed a survey of screening test?

2. After recording the VA score, what should you do?

3. What happens if the patient is still 20/20 (or their original VA score): if they can no longer read the chart?

4. If the patient fails this test, what should you do?

215. Relate a given list of terms pertaining to the actions of the eye muscles to their correct description.

Actions of the Eye Muscles. Each muscle has a specific job to do in order to make the eye move. This job is called the muscle action and is named after the movement of the eye that it causes. If a muscle turns the eye upward, the action is called an elevation; if the eye is turned downward, the action is called *depression;* if the eye is turned outward (temporally), the action is *abduction;* and if the eye is turned inward (nasally), the action is *adduction*. If the eyeis rotated so that the top of the iris seems to move nasally while the bottom moves temporally, the action is *intorsion*. If the top moves temporally and the bottom moves nasally, the action is *extorsion*.

Each muscle can perform more than one action. The primary action of a muscle is the main action performed by that muscle when it moves from the primary position (position of rest) to another position.

Whenever two muscles work together to help perform the same action in the same eye, they are called synergists. Whenever two muscles act in opposition to each other in the same eye, they are called antagonists. Examples include the superior rectus and inferior oblique of the same eye acting together to synergistically elevate the eye. The superior and inferior recti of the same eye are antagonists. (One tries to elevate while the other tries to depress.)

Two muscles that perform the same action in opposite eyes are called yoked muscles; for instance, the LLR and RMR are yoked to turn the eyes left. Other yoked pairs are the LSR–RIO, LIR–RSO, RSR–LIO, and RIR–LSO.

A version is a conjugate binocular movement (both eyes move together in the same direction—right, left, up, or down). A vergence is a disjunctive binocular movement—as in convergence (both eyes turned in) or divergence (both eyes turned out).

Normally, the position of rest of the eyes is the position attained when the eyes are dissociated or kept from normal binocular vision (as when one eye is covered). If the eyes appear parallel (looking straight ahead) while dissociated, this is a normal condition of muscle balance, and is called orthophoria.

Exercises (215):

1. Match each item in column B with its correct description in column A.

Column A

______ (1) Two muscles that perform the same action in opposite eyes.
______ (2) Two muscles that perform the same action in the same eye.
______ (3) Two muscles that act in opposition to each other in the same eye.
______ (4) The specific job each muscle has to do to make the eye move.
______ (5) Action in which the eyes move together in the same direction.
______ (6) Action in which both eyes turn in or both eyes turn out.
______ (7) Location when the eyes are dissociated or when the eyes are covered.
______ (8) Normal condition of muscle balance in which the eyes appear parallel while dissociated.
______ (9) Action in which the eye is turned out (temporally).
______ (10) Action in which the eye is turned downward.
______ (11) Action in which the eye is turned inward (nasally).
______ (12) Action in which the eye is turned upward.
______ (13) Action in which the eye is rotated so that the top of the iris seems to move nasally while the bottom moves temporally.

Column B

a. Elevation.
b. Intorsion.
c. Antagonists.
d. Version.
e. Yoked muscles.
f. Adduction.
g. Position of rest.
h. Depression.
i. Orthophoria.
j. Action.
k. Synergists.
l. Vergence.
m. Abduction.
n. Extorsion.

Column A

______(14) Action in which the eye is rotated so that the top of the iris seems to move temporally while the bottom moves nasally.

216. Given a list of terms relating to deviations of the eye muscles from the norm, identify each by matching it with an appropriate description.

Deviations of the Eye Muscles. Sometimes a muscular or neural anomaly develops in which the eyes do not point directly at the object of regard. If one eye fixates (looks at) an object, and the other wanders or drifts to a position other than fixating the object, the patient is said to have a heterotropia (or strabimus or squint).

A heterotropia may be defined as a manifest (obvious) deviation of the eyes—a condition in which one eye refuses to fixate on an object when both eyes are open. Heterotropias may be classified as "*ex*otropia" (one eye turns out) or "*es*otropia" (one eye turns in). Heterotropia may be further classified as "right" or "left," depending on the deviated eye. If a patient's right eye crosses or looks *inward* while attempting to fixate a distant object, that patient is a right esotrope (RET). If the left eye deviates *outward*, the patient is a left exotrope (LXT).

Sometimes one eye turns upward or downward. You may think that this condition would be called a hypertropia (up) or hypotropia (down), and you would be partly right. In identifying a vertical deviation, the name of the deviation is always "hyper-" and the eye is that which turns upward. If a patient has a left eye that manifestly deviates downward, they are a "right hypertrope (RHT)."

Sometimes first one eye and then the other may deviate. This is called alternating exotropia (AXT) or alternating esotropia (AET).

An Intermittent lateral tropia (one that happens only occasionally) is indicated by placing the "T" in parenthesis. You would indicate your results for near by placing an apostrophe after the abbreviations as follows:

Distant	*Near*
E	E'
X	X'
RET	RET'
RXT	RXT'
AXT	AXT'
RE(T)	RE(T)'

Muscular anomalies are not always simple manifest deviations. Sometimes a person can properly fixate an object binocularly, but when one eye is covered so that it cannot see the object (occlusion), it may drift in, out, up, or down. This "latent" (hidden) deviation of an eye is called heterophoria and may be divided into "eso," "exo," and "hyper" just as the tropias are. However, they are *not* classified as to which eye is affected (except for the hyper condition.

Exercises (216):

1. Match each column B item with its correct description in column A.

Column A	*Column B*
______(1) To look at an object.	a. Esotropia.
______(2) Condition in which one eye turns inward when attempting to fixate an object binocularly.	b. RET.
______(3) Condition in which one eye turns outward when attempting to fixate an object binocularly.	c. Hypertropia.
______(4) Condition in which one eye wanders or drifts instead of fixating upon an object.	d. Fixate.
______(5) Right esotrope.	e. Exotropia.
______(6) Left exotrope.	f. Heterophoria.
______(7) A vertical deviation of one eye upward during binocular vision.	g. Alternating exotropia.
______(8) Condition in which either eye may deviate inward during binocular vision.	h. LXT.
______(9) Condition in which either eye may deviate outward during binocular vision.	i. Alternating esotropia.
______(10) Condition in which one eye may drift when the other eye is covered, but does not drift with binocular vision.	j. Heterotropia.

217. Given hypothetical results of the cover test, interpret them in terms of the patient's muscle balance or imbalance and indicate procedures for testing and recording muscular deviation.

Now that you know the names of common muscular anomalies, the next step is to learn some tests designed to identify and differentiate tropias and phorias.

Cover Test. The first procedure, designed to detect both tropias and phorias in the eye lane, may be modified to differentiate the two. This test is called the cover test, and may be divided into two portions—the alternate cover test and the cover-uncover test. The cover is to be performed on essentially all physicals that are performed with the optometry clinic as consultant.

The first portion of the test is the alternate cover test at 20 feet. Instruct the patient to fixate a spot of light on the wall about 20 feet away while you alternately cover one eye and then the other with an occluder. If the patient is ortho (has normal muscle balance), you will see no movement when you switch the occluder from one eye to the other. If the patient has a muscle imbalance, you will note movement and direction.

If the eye turns *in* upon uncovering, it must have turned *out* when covered (dissociated); this means that the patient is exo. Conversely, if the eye turns *out* upon uncovering, it was *in* with dissociated, and the patient is eso. A similar relation exists for vertical imbalances.

Once the direction of the anomaly has been established, the cover-uncover test is used to determine whether the imbalance is a tropia or a phoria. In this portion of the test, permit the patient to fixate binocularly at a point 20 feet away.

This test is more involved than what meets the eye. You will occlude one eye while watching the unoccluded for movement. When you remove the occluder watch both eyes. During this process, if you noted one eye move, the one that was under the occluder, your patient probably has a heterophoria. On the other hand, if no eyes or both eyes move, they probably have a heterotropia. You are essentially finished if you find its a heterophoria condition; one eye moves. If it is a heterotropia condition, you need to go the other eye and go through the process again. Why? In a tropia, you recall, the condition is named by the deviating eye.

Just a little more reasoning to help clarify this. Think to yourself how heterophorias behave. They goof-off when not being used or are hidden like some technician you know. This explains why only one eye is seen moving and that eye being the one that was occluded, because the other eye is fixating or doing its job and will continue doing so until it gets its chance to be covered. Let's examine the heterotropia. You have to test until you figure out which eye is the working eye, or exactly what condition is present in the patient. Example, the patient is a right exotrope. Is his or her right eye going to move when it's covered? No! You have no eye movement when you uncover the right eye. What will happen if you cover the left eye? Aren't the eyes yoked together? Of course they are, and the left eye is forced to move because the right eye has to go to work. Two eyes move. What will happen when the left eye is uncovered? Right, the left takes over fixating.

Now that you have successfully completed the cover tests at far, it is required that you do it at near or 14 inches.

The amount of the deviation can be measured in the following manner: If an exo deviation is found with the cover test, place a base-in prism over the deviating eye. Repeat the cover test, gradually increasing the prism power until no deviation is noted. The prism value is then equivalent to the deviation of the eyes. If an eso deviation was originally noted, perform the same procedure with a base-out prism. Similarly, a base-down prism may be used to find the amount of deviation of a hypertropia.

If the alternate cover test reveals no movement, enter the notation "CT ortho" in item 62, SF 88, or in appropriate blocks of DD Form 741, Eye Consultation, or a local form. If movement is seen, enter type and direction. Enter the amount and character of the anomaly in item 73, SF 88.

Exercises (217):

1. Match each result of the cover test in column A with the correct condition that it relates to in column B.

Column A	*Column B*
_____ (1) In the alternate cover test, the patient's eye turns *out* upon uncovering.	a. Heterotropia.
_____ (2) In the alternate cover test, the patient's eye turns *in* upon uncovering.	b. Esophoria.
_____ (3) In the cover-uncover test, the eye not being tested moves when the other eye is covered.	c. Heterophoria.
_____ (4) In the cover-uncover test, the patient's eyes are able to binocularly fixate between occlusions.	d. Exophoria.

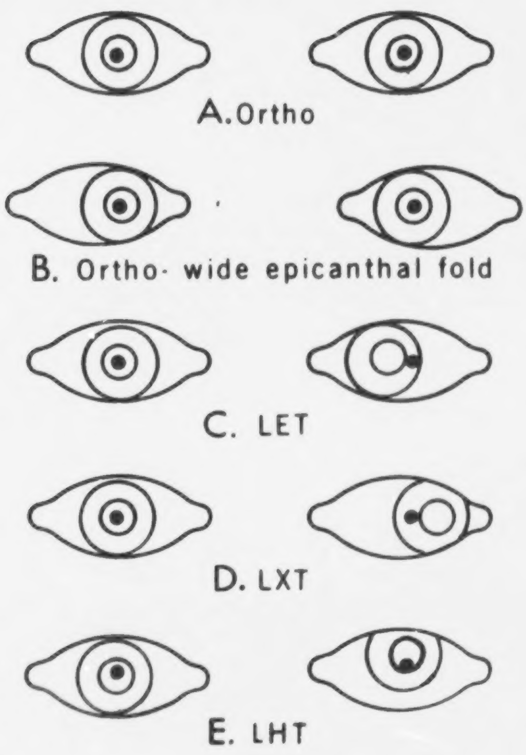
2. How can the amount of the patient's muscular deviation be tested?

3. If there is no movement of the eye, what you you enter on the form?

218. Given specific results of the Hirschberg and Diagnostic H tests, specify how the results should be recorded on the examination record by matching each result with its appropriate notation.

Hirschberg Test. You may want to try this test on children to determine the presence or absence of a false esotropia caused by a wide epicanthus. The epicanthus is a fold of skin between the eyes and the nose, and if this fold of skin is too wide, the child may appear crosseyed, but actually be orthophoric.

Figure 1-21,A, shows the reflexes or penlight reflections in an orthophoric patient looking at your penlight. Figure 1-21,B, shows the reflexes in an orthophoric patient with a wide epicanthal fold. Figure 1-21,C, indicates a left esotropia. Note how the reflex has moved away from the pole of the cornea. Figure 1-21,D, reveals a left exotropia by the nasalward displacement of the reflex. Figure 1-21,E, shows a left hypertropia.



A. ORTHOPHORIA.
B. WIDE EPICANTHUS.
C. LEFT ESOTROPIA.
D. LEFT EXOTROPIA.
E. LEFT HYPERTROPIA.

Figure 1-21. Examples of Hirschberg test results.

Obtaining high accuracy of measurement with this test is difficult since each millimeter of displacement is approximately 8° of tropia. Figure 1-22 shows a way of estimating the amount of deviation of the nonfixating eye by noting the position of the reflex.

Diagnostic H Test. So far, you have learned to differentiate a phoria from a tropia and how to measure these anomalies. All the tests thus far have been performed with the eyes pointed straight ahead, or nearly so. The next test—the Diagnostic H—determines which muscle, if any, is paretic or paralyzed in a strabismus or tropia.

This test is based on the fact that, in certain positions of the eye, motion of the globe to another specific position is effected by only one extrinsic muscle. During this discussion, try to remember the basic anatomy of the extraocular muscle system (see fig. 1-23).

It is fairly easy to visualize the fact that the medial rectus adducts (turns in) the eye from any horizontal position. Similarly, the lateral rectus abducts (turns out) the eye from any horizontal starting position. When the eye is greatly abducted, the only elevator is the IO, while the only depressor is the SO.

Administer this test in a fairly well-lighted room. Seat the patient facing you and have them fixate a penlight or muscle light held at about a 24-inch distance in the centerline at eye level. Instruct the patient to fixate the penlight at all times. While administering this test, observe the position of the reflection of your light from the patient's corneas (corneal reflex) in relation to some point reference, such as the pupil. Now move the light to your right. If the patient's eyes follow the light (to about 50°-60°) the LLR and RMR are intact. Now move the light about 50°-60° to the left of the centerline. If the patient maintains binocular fixation, the RLR and LMR are intact. Now elevate the light about 30° while the patient is looking right. If both eyes follow this elevation, the LIO and RSR are intact. Depression of the fixation light about 30° while the patient is looking right checks the condition of the LSO and RIR. Return the light to a position so that the patient is looking far left and up. This checks the LSR and RIO. Depression of the light checks the LIR and RSO. If the patient can follow the light in all of the above-mentioned positions, record the results as "EOMS-Full" (Extraocular Movement - Full) or "Muscle action, full and unrestricted" on the DD Form 741, Eye Consultation, or local form. If the patient cannot tract in one or more positions, record this as possible paresis of the muscle affected ("Possible paresis RIO," for example) and notify the doctor.

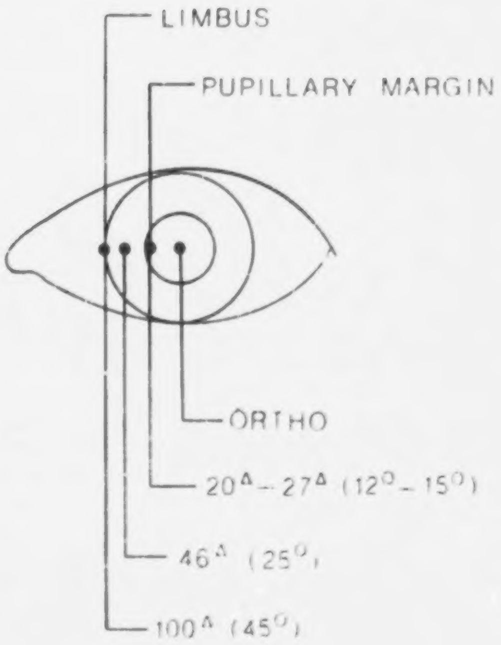


Figure 1-22. Estimation of amount of deviation using the Hirschberg test.

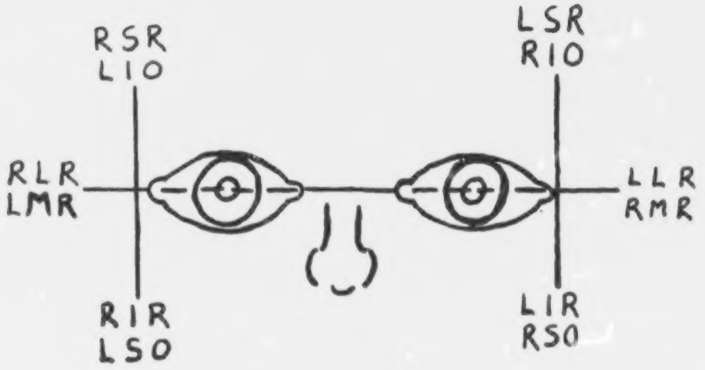


Figure 1-23. Diagnostic positions for muscle H test.

Exercises (218):

1. Match each notation in column B with the condition that it represents in column A.

Column A

______(1) When the light is moved about 50° to 60° to your right at eye level, the patient's right eye does not follow.

______(2) When the light is moved about 50° to 60° to the left at eye level, the patient's left eye does not follow.

______(3) When the light is elevated about 30° while the patient is looking right, the right eye does not follow.

______(4) When the light is elevated about 30° while the patient is looking right, the left eye does not follow.

______(5) When the patient is looking far left and up, the right eye does not follow.

______(6) When the patient is looking far left and up, the left eye does not follow.

______(7) When the light is depressed to your right, the patient's right eye does not follow.

______(8) When the light is moved about 50° to 60° to your left at eye level, the patient's right eye does not follow.

______(9) When the light is moved about 50° to 60° to your right at eye level, the patient's left eye does not follow.

______(10) When the light is depressed to your right, the patient's left eye does not follow.

______(11) The patient can follow the light in all positions.

______(12) When the light is depressed to your left, the patient's left eye does not follow.

______(13) When the light is depressed to your left, the patient's right eye does not follow.

______(14) Condition in which the reflexes are centered in the pupils.

Column B

a. Possible paresis LLR.
b. Possible paresis LIO.
c. Possible paresis LIR.
d. Possible paresis RMR.
e. Possible paresis RLR.
f. Possible paresis LMR.
g. Possible paresis RSO.
h. Possible paresis RIO.
i. Possible paresis LSR.
j. EOMS-Full.
k. Possible paresis LSO.
l. Possible paresis RIR.
m. Orthophoria.
n. Possible paresis RSR.

219. Specify the purpose, application, and interpretation of the near point of convergence test.

The Near Point of Convergence Test (NPC). The last muscle test we will consider is called the NPC or near point of convergence. This is a test to determine how close to the eyes an object may be brought before the patient's eyes stop converging and the patient either sees double (diplopia) or suppresses one eye.

With the patient seated before you as in the last test, have them fixate your penlight or other suitable target held at about 24 to 30 inches distance. (This test is invalid for most heterotropes.) Ask the patient to tell you when they see two lights. Slowly move the light toward the bridge of the patient's nose, noting the distance when they see double and again noting the distance when their eyes diverge (break fusion). Record the result as "NPC ____________." This distance measured from the bridge of the patient's nose with the aid of a Prince or a PD rule.

Near point of convergence is determined for all personnel being examined for flying qualification in Classes I and II. Candidates for flying training will *not* be allowed to wear corrective lenses while being tested for near point of convergence. With the zero mark of the Prince rule placed approximately 15 mm from the anterior corneal surface, the point of convergence is that point on the rule which marks the greatest convergence of the eyes. It is measured in millimeters. If corrective lenses are necessary to meet the distance or near vision acuity standards, the correction will be worn during this examination. Do *not* record the unit of measurement in item 62, SF 88 (millimeters are understood).

Prolonged repetition usually tires the extraocular muscles and gives erroneous measurements. Before a patient is disqualified for insufficient power of convergence, examine him or her on two successive days and record the nearest point of convergence.

Exercises (219):

1. What does the PC test determine?

2. When the patient's eyes stop converging, what two things may happen?

3. What is the term for seeing double?

4. The near point of convergence is determined for whom?

5. What is one special rule that applies to candidates for flying training?

6. When using the Prince rule to measure the point of convergence, where is the zero mark placed?

220. List the types of pupillary reflexes and name the stimulus for each, and cite your responsibility with relation to pupillary reflex tests.

Pupillary Reflexes. The pupillary reflex tests are objective neurological tests for integrity of the visual system (with the exception of the cortical centers). Pupillary reflex tests are of importance in detecting and diagnosing the presence of cranial lesions in or near the visual pathway. It is your responsibility as an optometry specialist to be able to differentiate between normal and abnormal pupillary reflex responses. The pupillary reflexes may be divided into three responses: (1) direct, (2) consensual, and (3) accommodative.

Pathway for the direct pupillary reflex. The direct response originates in the light-receptive cells of the retina; it then travels back along the optic nerve, through the semidecussation (splitting in half) at the optic chiasm, and backwards along the optic tract to the LGB (lateral geniculate body). (See fig. 1-24.) Fibers run from the LGB to the pretectal nucleus and the homolateral (same-sided) III nerve nucleus, where parasympathetic fibers run along with the III nerve to the ciliary ganglion. From the ciliary ganglion, fibers extend forward to the pupillary sphincter. Light entering one eye causes a reflex to follow the above path, causing the pupil of the stimulated eye to constrict.

Pathway for the consensual pupillary reflex. The consensual pupillary reflex follows a similar afferent (to the brain) pathway as does the direct reflex. Light entering one eye stimulates that retina, and the signal travels backwards along the optic nerve, chiasm, and tract to the LGB. After synapsing in the LGB, fibers run to the pretectal nucleus and then to the contralateral (opposite side) III nerve nucleus. The efferent (from the brain) fibers follow the same pathway as before. Light entering one eye causes the contralateral pupil to constrict. (Refer again to fig. 1-24.)

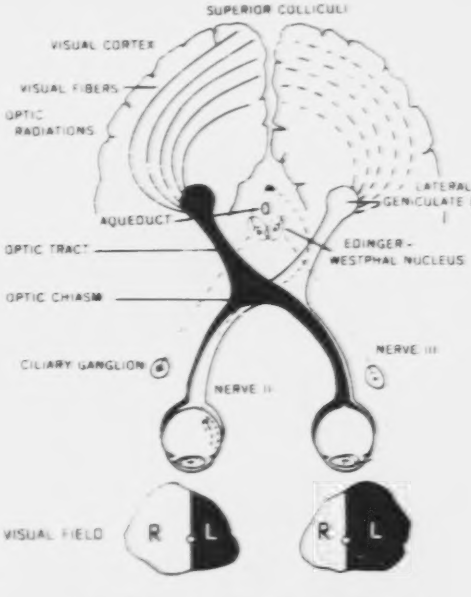


Figure 1-24. Pathway of the pupillary reflex.

Pathway for the accommodative pupillary reflex. The third pupillary reflex is initiated by an accommodative stimulus (usually a blur). The impulse travels from the III nerve nucleus, following parasympathetic fibers along the III nerve. These fibers eventually reach the ciliary ganglia and the pupillary sphincters of each eye. When an individual looks at something at near point, three things happen: (1) the eyes converge; (2) they accommodate (focus at near point); and (3) the pupils constrict.

The neurologist, knowing the location of the various nerves that mediate the pupillary reflex, can effectively localize the position of various lesions that may affect these pathways.

Exercises (220):

1. Name three types of pupillary reflexes.

2. What is sufficient stimulus for each type of pupillary reflex?

3. What is your responsibility with relation to the pupillary reflex tests?

221. Specify procedures for administering and interpreting the pupillary reflex tests.

Pupillary Reflex Tests. As stated before, there are three types of pupillary reflex tests. You, as an optometry specialist, should know how to determine and record the pupillary reflex in the proper manner.

Test for direct pupillary reflex. In eliciting the direct reflex, room lighting should be even. Occlude the eye not being tested; then shine a penlight into the eye being tested. That pupil should constrict markedly. After noting the rate and symmetry of constriction, turn the light off. The pupil should dilate or expand almost immediately. Then repeat the test for the opposite eye.

Test for consensual pupillary reflex. In performing the test for determination of the consensual reflex, the procedure is similar. Again, room lighting should be even. Shield one eye from the penlight, but not from your view. Then shine the penlight into the eye that is not shielded from the light while observing the eye that is shielded. The pupil of the shielded eye should constrict slightly when you shine light into the nonshielded eye. After determining the reflex for one eye, the process should be repeated for the other eye. With practice, you can elicit, observe, and record both the direct and consensual reflexes at the same time.

Test for accommodative pupillary reflex. The accommodative or near point reflex is again tested in an evenly lighted room. Both eyes are open for this test. Instruct the patient to look from an object located at far point to an object located at near point. The pupils should constrict when the patient looks at an object at close range. If the near point object consists of fine letters and if this object is gradually brought closer to the eyes, both pupils should constrict a greater amount as the target is brought closer.

On observation of the pupillary reflexes, the constriction of the pupils should be balanced. In the direct response, the pupils should constrict at the same speed, should remain round, and should be equal in size at the start and stop of the test. There should also be an equality in the consensual pupillary reflex. Observation of the accommodative reflex should include whether both pupils constrict equally and simultaneously.

Recording the pupillary reflex test. Record the pupillary reflex tests on SF 88 (item 26) as "PERRLA" (*P*upils *E*qually *R*ound and *R*eact to *L*ight and *A*ccommodation) if the responses are normal. If the responses are abnormal, record the abnormality and notify the doctor. The same procedure may be used on any local form used in the clinic.

Exercises (221):

1. How should you light the room for the pupillary reflex tests?

2. What are three factors to check when administering the pupillary reflex tests?

3. How should the pupillary tests be recorded if the responses are normal?

4. If the responses are abnormal, what should you do?

1-6. Vision Test Apparatus, Near and Distant (VTA-ND)

We have discussed the preexamination data that is recorded on the patient's treatment record form, the three types of preliminary vision tests—the visual acuity, the muscle balance, and the pupillary reflex tests—and the knowledge of eye anatomy and physiology basic to your duties as an optometry specialist. Now let's take a look at some of the instruments used to measure visual acuity and to give other preliminary eye tests. In this section, we will discuss the VTA-ND (fig. 1-25), one of the most commonly used vision screening devices, available in almost every eye clinic in the AF. Complete instructions for operation and maintenance of the VTA-ND may be found in AFM 160-17, *Examination Techniques*.

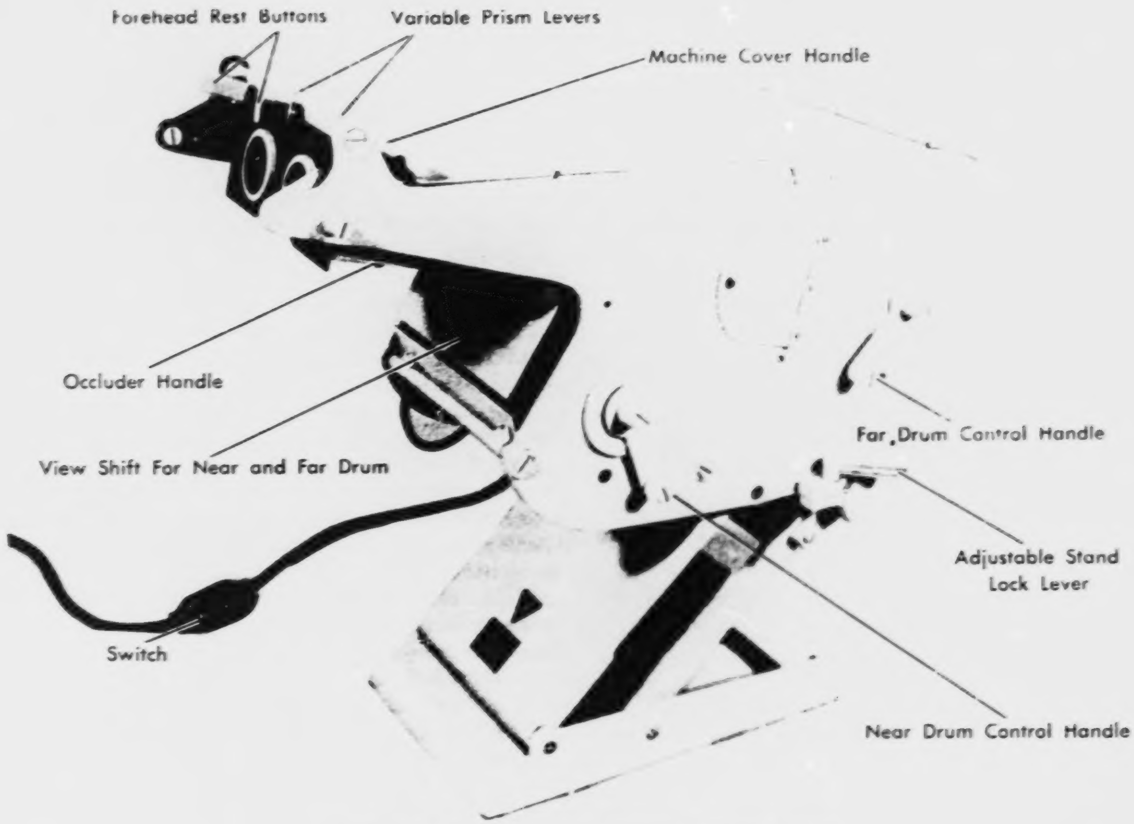


Figure 1–25. The VTA–ND (vision test apparatus, near and distant).

The vision testing apparatus combines the testing of several visual functions. It is the test of choice for all flight physical examinations and should be used if available. When the machine test is used, the following tests will not have to be performed in the 20-foot eye lane:

- Distant vision.
- Heterophoria.
- Near vision.
- Depth perception.

222. State procedures for operating the VTA–ND.

Operation of the VTA–ND. The patient observes a series of test slides, some of which test distance vision, while others test near vision. You, as the examiner, ask standard questions while the patient is observing each slide, and determine the patient's instrument score from the answers to these questions. The visual functions tested are vertical and lateral phoria at distance and near, right and left eye acuity at distance and near, and depth perception at distance.

The instrument may be adjusted for individual differences in eye height by lifting or pressing on the instrument at the back. The brake lock lever at the right near the rear pivot may be tightened just enough to permit a change in elevation by slight pressure on the instrument.

The distance slides are in the large drum rotated by a crank into any of eight positions. The near slides are in the small drum, rotated by a crank into any of five positions. A spring stop holds each drum accurately at any position. A different test slide is presented at each position.

The distance slides are viewed by the patient at a slightly downward angle, and the near sides at a greater downward angle. Each drum has an inside light operated by a single switch on the power cord of the instrument. Two small red windows in the side of the instrument show when the lights are on.

The viewing box is tipped up for the far slides or down for the near slides. The change can be made from one position to the other without disturbing the patient's head position (except for presbyopes wearing bifocal spectacles). An occluder operated by means of a handle under the viewing box may be turned to block the view of either eye.

In addition to the vision tester itself, the equipment includes one demonstration device, an answer key, and a supply of record sheets. Place the instrument and the auxiliary equipment on a substantial table 28 inches to 30 inches high with knee room beneath it, and at least several square feet of top-surface area. Chairs should be straight and not inclined backward. Connect the instrument to a 110–120 volt outlet.

Exercises (222):

1. If the VTA-ND is not the correct height for the patient, how should you adjust it?

2. How do you prevent the instrument from shifting elevation during the test?

3. When you have shown the first distance slide, how do you turn to the second slide?

4. How is each drum held at any desired position?

5. Is the angle at which the patient views the far slides less than or greater than the angle at which he or she views the near slides?

6. How do you turn on the drum light?

7. To change from the far to the near slides, which patients should have their head positions changed?

8. What is included in the equipment to explain the test to the patient?

9. To enable you to score the test, what does the equipment include?

10. What are two requirements of the table on which the instrument is placed?

11. The chairs should not be in what position?

12. What should you connect the instrument to?

223. Specify the maintenance and adjustment of the VTA-ND.

Maintenance and Adjustment of VTA-ND. Test slides may be removed for replacement when necessary. Lifting the lid of the instrument gives access to the slides in the far drum. Slides in the near drum are reached by withdrawing the pin stop that limits the downward movement of the viewing box and swinging the box lower to a secondary stop provided for that purpose. Dust the bulbs occasionally, and replace them if they appear blackened. A slight counterclockwise rotation of the external portion of the light socket releases the entire bulb assembly so that it may be withdrawn from the instrument. If the bulb needs to be replaced, slide the metal cap off the bulb before removing it from the socket. When a new bulb is screwed into the socket, position it precisely as it was before. The proper position for the bulb can be ascertained by observing the relationship between the support wire and the slot in the socket assembly in the case of the original bulb. (When you insert the bulb in its socket, hold the socket assembly so that the slot is at 7 o'clock and place the bulb so that the filament support is located between the 1 and 5 o'clock positions. Place the metal cap over the bulb with the bar at approximately 3 o'clock.) Each cap is stamped on the end with the letter "N" or "D." The cap marked "N" is for the lamp in the near drum, and the one marked "D" is for the distance drum. These caps control the evenness and intensity of illumination and must always be used in their proper places.

The patient should sit in front of the instrument, placing the chair under the table as far as is comfortable. The chair must be squarely facing the instrument. Adjust the height of the instrument so that the patient can rest the forehead against the headrest. In the correct position, the patient is looking through the center of the viewing lenses. When the viewing box is lowered to the near slides, patients should not have to move their head (except for presbyopes wearing bifocal spectacles); they still look through the center of the viewing lenses. The centerline of vision for the distance tests is *not* parallel with the top of the instrument, but at a slight downward angle directly in line with the main hinge of the viewing box and the shaft of the big drum. The patient's eyes should be centered on this line. For the near tests, the centerline of vision is in line with the main hinge on the viewing box and the shaft of the small drum. Watch constantly to see that the patient's forehead is against the headrest, both eyes are kept open without squinting, and the head is not tilted.

Exercises (223):

Identify each true statement and explain why the others are false.

TABLE 1–3
SEQUENCE OF TESTS, VTA–ND

Name of Test	Drum	Position No. and Slide No.
Far vertical phoria	Far	1.
Far lateral phoria	"	2.
Far acuity	"	3 and 4 or their alternates 3A, 4A.
Depth perception	"	5 or its alternate 5A.
Near vertical phoria	Near	6.
Near lateral phoria	"	7.
Near acuity	"	8 and 9.

____ 1. You can remove the slides in either the far or near drum by lifting the lid of the VTA–ND.

____ 2. The entire bulb assembly may be removed by a slight counterclockwise rotation of the external portion of the light socket.

____ 3. When the bulb is replaced, the slot in the socket assembly should be held at 7 o'clock, the filament support should be between 1 and 5 o'clock, and the bar of the metal cap over the bulb should be at 3 o'clock.

____ 4. The same metal cap can be used over the bulb in either the distance or near drum.

____ 5. The function of the cap is to protect the bulb from breakage.

____ 6. The patient rests his or her forehead against the headrest.

____ 7. With one exception, the patient should not have to move his or her head to view the near slides.

____ 8. The patient's centerline of vision for the distance tests should be parallel with the top of the instrument.

____ 9. For the near tests, the patient's centerline of vision is parallel with the hinge on the viewing box and the shaft of the small drum.

____ 10. There are no further precautions to take in administering the test.

224. Assign appropriate scores to described results of tests 1 through 9 on the VTA–ND and cite basic procedures for administering the test.

Tests 1 Through 9. The tests are given in the order shown in table 1-3. Tests 1 to 5 are in the back or far drum. Each patient makes an instrument score on each test. This score is a number or letter that indicates the patient's performance on the machine; it is not a numerical measure of the visual ability tested. For example, in the vertical phoria test, a score of 9 is not superior to a score of 1, and a score of zero does not mean complete absence of the ability tested. The scoring key found in Appendix B gives the correct or true score for each instrument score. Enter the "true score" on the eye exam form.

Drum position 1, far vertical phoria. Place the occluder in the midposition so that it does not block either eye and instruct the patient to put his or her head against the headrest. Then ask the standard questions: "Do you see a white dotted line?" "Do you see a row of numbered stairsteps?" "Where is the dotted line in relation to the numbered steps?" If the patient says "No" to the first or second question, put the occluder before the left eye and ask "Do you see some stairsteps?" Then with the occluder before the right eye, ask, "Do you see a white dotted line?" With the occluder in the midposition, ask, "Now do you see both the dotted line and the stairsteps?" If the patient says "No" to any of these three questions, discontinue the test. If the patient says "Yes," repeat the standard questions. The instrument score is the number (1–9) that the patient answers. If the dotted line is below step 1, the score is zero; if above step 9, the score is 10. If the test is discontinued because of failure to see either the dotted line or the stairsteps, the score is X. (CAUTION: All answers of 1, 2, 8, or 9 should be verified by asking, "Is the dotted line as high as the top (or bottom) of the stairsteps?")

It would be possible for the patient to fake a normal phoria if he or she knew that a score of 5, for example, is normal, to avoid this, an auxilliary device is provided so that the examiner can lower either the right or the left eye image. This device is knowns at the variable prism. Its two control handles are located above the viewing lenses. The correct score and the only score recorded is that obtained when both control handles are pushed inward as far as they will go. This is known as the scoring position. Moving the left handle outward from this position moves the left eye image downward and outward. Similarly, moving the right handle outward moves the right eye image downward and outward. The maximum amount of downward shift provided by each control corresponds to four scale divisions. Moving the right handle outward to its extreme position, therefore, will change the apparent location of the dotted line from step 1 to step 5, for example, or from 6 to above 9, etc. Moving the left control handle outward to its extreme position, similarly will change the apparent location of the dotted line from step 5 to step 1, or from step 8 to step 4, etc. Vary the location of the right or left control handle, each time asking the patient to report the location of the dotted line. Only one of these answers—that is, the answer obtained when both handles are in the scoring position—gives the patient's score on the test.

Drum position 2, far lateral phoria. The procedure for this test is similar to that for vertical phoria. The standard question is, "To which number does the arrow point?" If the patient says that it does not point to any number or is between two numbers, ask, "To which number is it closest?" If the patient does not see the arrow or does not see the numbers, follow the procedure described in the previous test. If the patient says that the arrow moves over a wide range, say, "Look closely at the arrow. Tell me where it is when you first see the numbered dots." Discontinue the test if the patient cannot see both the arrow and the numbers at the same time. Failure to see either the arrow or the numbers will be scored X as in the previous test. The instrument score is the number (1 through 21) that the patient answers. The score is 22 if the arrow is to the right of 21. (CAUTION: If the patient answers that the arrow "points to the second one," verify that he or she means the dot between number 1 and number 3, and not the second number.)

By means of the variable prism previously mentioned, the right and left eye images can both be shifted outward a maximum of seven dots. To produce this outward shift without a downward shift, move both control handles outward simultaneously the same distance. When both handles are moved as far out as they go, the apparent position of the arrow is moved seven dots to the left, giving a score of seven below the true score. As in the previous test, the correct score and the only score recorded will be that obtained when the control handles are in the scoring position—that is, when both are pushed inward as far as they will go.

Drum positions 3 and 4, or 3A and 4A, far acuity. Previous tests were given with the occluder in the midposition, but in this test, remember to occlude the left eye when the right is tested and vice versa. The prism control handles must be in the scoring position. Slide 3 and its alternate, slide 3A, contain the smaller letters; slide 4 and its alternate 4A, the larger ones. (Alternate slides are provided in case the patient has memorized the order of the letters on a line which they cannot actually read.) On slides 3 and 3A, there are 20 letters of each size. Only 10 of the 20 letters of each size need be used. Thus, ask the patient to read lines 5 and 5A, 6 or 6A, etc.

Tell the patient, "Read the letters on line 5 at the top of the chart." (Line 5A may be used instead.) If the patient makes more than three errors, continue the test with the larger letters on slide 4 or slide 4A. If the patient makes three or fewer errors in line 5 or 5A, then say, "Look at the smaller lines of letters on the left and the still smaller ones on the right. What is the smallest line you can read easily?" From this point on, proceed in any way you wish to determine the smallest line of letters that the patient can read with not more than three errors in 10 letters. (To obtain a score for any given line of 10 letters, the patient must call off correctly seven or more letters in that line. Alternately expressed, the patient will be allowed to make three errors in any line of 10 letters and still receive the score for that line.) The patient's instrument score on this test will be the number of the smallest line of letters on which not more than three errors in 10 are made. Only 10 letters of each group need to be used unless you suspect malingering or wish to verify the patient's final score by having him or her read a second 10 letters of the same size.

If the patient cannot read lines 5 or 5A with three or fewer errors, determine the acuity score using slide 4 or its alternate, slide 4A. There are four sizes of letters on this chart corresponding to instrument scores 1 to 4. The lines are not numbered on this slide. The top line represents a score of 1. The second and third lines from the top represent a score of 2. The fourth line represents a score of 3, and the bottom line a score of 4. Have the patient start with the top line of three letters. If the patient makes one error or no errors on the top line, have him or her to continue with the smaller letters until four or more errors are made in reading the 10 letters of a size. (To obtain a score for any given size of 10 letters, the patient will be allowed to make three errors in any size of 10 letters and still receive the score for that size.) The instrument score is given by the letter size for which not more than three errors in 10 are made; an exception is made for the top line of three letters, of which two must be read correctly to give a score of 1. If more than one error is made, the instrument score is 0.

Drum position 5, depth perception. This is explained in chapter 2. Now move the viewing box down for near testing.

Drum position 6, near vertical phoria. The procedure for administering the near phoria test is the same as the procedure described above in test 1 for far vertical phoria.

Drum position 7, near lateral phoria. The procedure is the same as in test 2, far lateral phoria.

Drum positions 8 and 9, near acuity. The procedure is the same as in tests 3 and 4, far acuity.

In all tests performed on the VTA-ND, we remind you, are scored using the "true" score. You will need to use the scoring key to convert the instrument scores to true scores. As an example, the acuity line 5 is the instrument score but you would put the true score of 20/50. When giving the phoria tests, you will have to interpret the patients instrument score and put the true score reflecting diopters of prism.

Exercises (224):

1. Match each score listed in column B with the result of the test as described in column A.

Column A

_____(1) The patient sees only one of the targets.
_____(2) In test 1, patient sees the dotted line below step 1.
_____(3) In test 1, patient sees the dotted line opposite step 5.
_____(4) In test 1, patient sees the dotted line above step 9.
_____(5) In test 2, the patient cannot see both the arrow and the numbers at the same time.
_____(6) In test 2, patient sees the arrow to the right of dot 21.

Column B

a. Score of X.
b. Score of 0.
c. Normal score.
d. Score of 2.5 RH.
e. Score of 11Δ EXO.

2. What is the score the patient makes on the test?

3. Where may the scoring key for the test be found.

4. What is a device that enables the examiner to determine whether the patient is faking a normal phoria called?

5. In what position are the control handles of the variable prisms supposed to be for a correct score?

6. By use of this device, how much can the apparent location of the dotted line in test 1 be changed?

7. What is the position of the occluder in tests 3, 3A, 4, and 4A?

8. In tests 3, 3A, 4, and 4A, why are alternate slides provided?

9. In tests 3, 3A, 4, and 4A, what is the patient's score?

10. What is the difference in the procedures for test 6, near vertical phoria, and test 1, for vertical phoria?

11. What is the difference in the procedures for test 7, near lateral phoria, and test 2, for lateral phoria?

12. What are tests 3 and 4?

225. Name the four tests most often given with the VTA–ND, and list several possible sources of error.

Discrepancies Between VTA–ND and Projectochart and Near Point Cards. Although use of the VTA–ND for flying physicals is required by regulation, most clinicians don't like to rely on the findings of this instrument. If you have used a VIA–ND, you have probably noted the difficulty in checking children, and you have probably also noted that acuities as found with the VTA–ND may differ as much as two lines when compared to those found with the Projectochart and near point cards. Some of the reasons for this discrepancy are explained below:

a. Due to the high magnification effect of the instrument, any dust or dirt or wear of the test slide degrades the image substantially.

b. Dirty lamps or optics also degrade the image.

c. Head position is critical, and wrong head position can also degrade the image, especially for bifocal-wearing presbyopes.

d. The closed-in effect of the instrument may cause a reflex accommodation for far point tests.

e. Many long-armed individuals do not have their habitual reading distance at the distance set in the instrument.

f. Undetected squinting may cause acuity to appear better than it actually is.

Although the complete series of tests should be given to any individual who is taking the eye tests in conjunction with a physical examination, it is usually not necessary to complete all the tests for a vision screening. The most commonly used test series for a vision screening on the VTA are the following, done through the patient's habitual prescription:

a. Distant monocular acuities.
b. Distant lateral and vertical phorias.
c. Near monocular acuities.
d. Near lateral and vertical phorias.

Pass/fail criteria for each test should be discussed with your optometrist, but considering the quality of the instrument and the B&L orthorater vision test standards, visual acuities of 20/30 are usually sufficient to pass, especially if no significant complaint exists. Phorias may be as high as 5 exo or 10 eso and still allow the patient to pass the screening with no referral.

Exercises (225):

1. What four series of tests are commonly given with the VTA–ND during a normal visual screening?

2. What are the most probable sources of significant error when performing VA tests with the VTA–ND?

1-7. Vision Testing Stereoscope

The Departments of Defense stocklists instrument other than the VTA–ND. It is listed in the *Federal Supply Catalog* as Stereoscope, Vision Testing, NSN 6515-00-082-1657, but is actually the Keystone Ophthalmic Telebinocular and can be ordered as such. Refer to figure 1-26.

226. Clarify particular concerns related to preparation procedures for testing with the vision testing stereoscope.

Testing with the Vision Testing Stereoscope. Some of the advantages of the vision testing stereoscope are:

- Easy to score and interpret.
- High correlation with eye-lane test results.
- Adaptability and versatility.
- Easy to use for either adults or children.

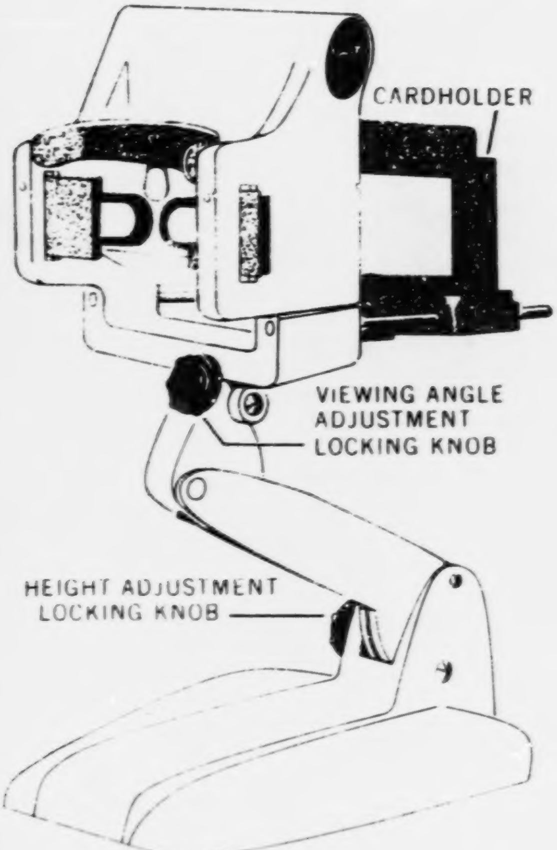

CARDHOLDER
VIEWING ANGLE ADJUSTMENT LOCKING KNOB
HEIGHT ADJUSTMENT LOCKING KNOB

Figure 1-26. Stereoscope, vision testing.

The test should be conducted in a quiet atmosphere free from noise, traffic, and glare. Room lighting should be subdued, with brilliant sunlight excluded. You, as the examiner, should be seated along the side of the table on which the instrument is placed—and to the right of the patient. It is important that you are able to face the patient, yet see and manipulate the target slides in the cardholder. It is also important that you have sufficient table space to accommodate the record forms and similar material.

Normally, the instrument is placed on a desk or table with a height of 26 to 30 inches from the floor. It should be located near the table's edge for patient convenience. (Be sure that adequate knee room is also provided.) The chairs for both the patient and you should be straight-backed. (It may be desirable for smaller children—through the age of 7 or 8—to stand during testing. A somewhat higher than normal table may be required, but most problems of correct posture can thus be eliminated.)

Before testing commences, check the instrument to see that it is in proper working order. It should be connected to a 110- to 120-volt electrical outlet, and the lamps should light when the switches are turned on. If necessary, the instrument should be dusted and the lenses cleaned with a soft lens tissue. If accessory headrest tissue cushions are used, be sure that the tissue exposed is clean and fresh.

Also check the test targets in the cardholder. The targets should be in proper sequence, and the back plate of the holder moved far enough forward to keep the targets upright, but not too tight to prevent easy change.

Good body posture is important to good vision; it is vital that proper posture be maintained during vision testing. An uncomfortable position will cause strain and distract the patient.

Seat the patient before the instrument and sufficiently close to it so that the patient's back and head are erect and shoulders are level but relaxed. The patient's feet should be flat on the floor or comfortably placed on a rung of the chair or stool. (If a small child is tested while standing, be sure that he or she remains erect with shoulders back and head straight.)

Adjust the height of the instrument viewing head so that the desired posture can be maintained throughout the test period. It may be necessary to loosen the locking knob at the rear of the support arms so that the head will move smoothly. The angle of tilt of the viewing head may also be adjusted as desired.

Rest the patient's forehead lightly against the headrest, and maintain this position during all tests. Do not allow the patient to pull back or away from the instrument between individual tests. And caution the patient not to tilt the head while tests are being conducted.

Patients who require corrective lenses should be tested with their glasses (or contact lenses) worn as usual. If lenses are required only for near vision or distance vision, they should be removed when testing those visual skills for which they were not prescribed.

Should the patient wear bifocals, adjustment of both the angle and height of the viewing head may be required. It is vital that both the spectacles and instrument be correctly adjusted so that the patient's line of vision passes unobstructed through the bottom of the bifocal segment for all near point tests.

In normal use, the telebinocular requires no maintenance except for the occasional replacement of the lamp bulbs. To avoid possible damage to the instrument, use only a 25-watt, frosted, showcase bulb in the target-illumination lamp and a 6-watt, 120-volt, white bulb in the patient eye inspection lamp. The former bulb is the same as that used in the VTA–ND, and the latter is a white Christmas-tree bulb.

To minimize cleaning, the instrument should be protected by the dust cover when not in use. Periodically, dust the body of the instrument with a soft cloth or brush and clean the lenses with a lens tissue or cloth. If the unit has become very soiled, it may be washed with a mild soap-and-water solution.

Exercises (226):

1. Name two conditions that should exist in the room in which testing is performed.

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2. What should the position of the examiner be in relation to the patient?

3. Briefly describe the placing of the instrument as to table space, height of table, and position of instrument on the table.

4. How should small children be positioned to insure correct posture?

5. List four checks that should be made of the instrument before testing commences.

6. Why is proper posture of the patient important?

7. What types of lamp bulbs should be used in telebinocular?

8. What are the steps in cleaning the telebinocular?

227. Given specific results of the Visual Skills Test 1, relate them to the eye conditions to which they pertain.

Keystone makes several series of test cards. These cards may be combined to set up a screening program most useful to your clinic. We will investigate these various test cards and some adaptations that may help you in your particular circumstances. The series of test cards used most often are the Visual Skills test set. It consists of 15 targets and a special recording form. Refer to Appendix C. The series is excellent for an in-depth screening or for determination of binocular acceptance of certain ophthalmic prescriptions.

Test 1, Simultaneous Perception at Far Point. Use card DB10A, Dog-Pig. Set the instrument at +0.25. Ask the patient, "What do you see?"

The sole purpose of test 1 is to determine whether both eyes see at the same time. If simultaneous perception is not present, only tests 5 and 6 can be given. If the dog and the pig are seen alternately, alternate suppression is indicated. If only the dog or only the pig can be seen, except by occluding the dominant eye, gross suppression is present. If neither the dog nor the pig can be seen when the other eye is occluded, blindness or high amblyopia exists. Small children may be asked to point to the pig on the *right* side or to the dog on the *left* side to verify that they are seeing both at the same time.

Exercises (227):

1. Match each test result in column B with the eye condition to which it most nearly relates in column A.

Column A	*Column B*
_____(1) Only the dog can be seen with binocular vision.	a. Simultaneous perception.
_____(2) The dog and the pig are seen alternately with binocular vision.	b. Blindness or high amblyopia.
_____(3) Neither the dog nor the pig can be seen even when the other eye is occluded.	c. Alternate suppression.
_____(4) Both the dog and the pig are seen.	d. Gross suppression.

228. Given specific results of Visual Skills Test 2, relate each result to the eye condition that it indicates.

Test 2, Hyperphoria at Far Point. Use card DB8C which shows a yellow line and red figures. Ask the patient, "Do you see a yellow line and the red figures?" "What figure does the yellow line touch?"

The head should be level in the telebinocular at all times. If hyperphoria is reported with Rx, repeat the test without Rx; the frame may be bent. (This test may well be used when adjusting glasses, especially in the case of strong corrections.) When the yellow line passes anywhere within the ball and the 0, mark "Expected." When the line passes through the cross, the reading is 2 diopters of *right* hyperphoria. When the line passes through the star, the reading is 3 diopters of *left* hyperphoria. If the yellow line fails to become stabilized and continues to move up and down, mark the limits of the swing. A variable hyperphoria has diagnostic significance. Answers may be verified by having the patient report when your pointer, held before the right eye, touches the yellow line. The fading of the yellow line at the point where it crosses a red figure has no diagnostic signficance; the phenomenon is probably due to retinal rivalry.

Exercises (228):

1. Match the test results in column B with the correct eye condition in column A.

Column A	*Column B*
______(1) Variable hyperphoria.	a. Yellow line continues to move up and down.
______(2) "Expected."	b. Yellow line passes within the ball and 0.
______(3) Retinal rivalry.	c. Yellow line passes through the cross.
______(4) Three diopters of left hyperphoria.	d. Fading of the yellow line where it crosses a red figure.
______(5) Two diopters of right hyperphoria.	e. Yellow line passes through the star.

229. Given hypothetical results of test 3, interpret the results by matching each with the eye condition to which it relates.

Test 3, Lateral Phoria at Far Point. Use card DB9, showing the arrow and numbers. Set the instrument at +0.25. Ask the question, "To what number does the arrow point?"

The patient is to report:

(1) To what number the arrow points at the instant the target is exposed by the quick removal of the stereogram in front of it.

(2) Whether the arrow remains under the initial number.

(3) Whether the arrow moves quickly under some other number and remains there.

(4) Whether the arrow swings, pendulum-like, between certain numbers for a time but eventually becomes stationary.

(5) Whether the arrow continues to swing.

If the arrow stands definitely at any point, recording should be made accordingly. In many cases, a response will be delayed by the apparent movement of the arrow. To assist in speeding a response, ask for a number within the range of movement. When this has been obtained, it can be ascertained how far each way the movement continues. If the movement continues in one direction, recording should not be made until the movement in that direction has stopped. Findings falling to the left of the "Expected" column (values greater than 11) indicate exophoria; to the right (values less than 8), esophoria. Normal values range from 11 (slight exophoria) to 8 (slight esophoria).

Exercises (229):

1. Match each column B item with its correct interpretation in column A.

Column A	*Column B*
______(1) The arrow moves quickly to some number larger than the "Expected" number and remains there.	a. Exophoria.
______(2) The arrow swings pendulum-like, between certain numbers but eventually moves to a number smaller than the "Expected" number and becomes stationary.	b. Normal phorias.
______(3) The arrow stops between 8 and 11.	c. Esophoria.

230. Interpret described results of Test 4, Binocular Coordination (Fusion) at Far Point.

Binocular Coordination (Fusion) at Far Point. Use card DB4K, which shows four balls. Set the instrument at +0.25. Expose the target quickly. The patient should report how many balls they see immediately upon exposure. There may be:

a. Three, remaining three, and in vertical alignment. This result shows that the eyes are postured habitually for single binocular vision, indicating fusion readiness.

b. Three, remaining three, but in oblique alignment. This is usually associated with a high phoria and indicates that fusion is maintained with effort.

c. Four, becoming three instantly. This result has practically the same significance as a above.

d. Four, becoming three slowly. The indication is that the eyes are not automatically positioned for fusion, with consequent lowering of performance. Check in "Doubtful" column.

e. Four, remaining four. This result shows poor or absent fusion.

f. Two balls. This is an indication of gross suppression. Look for amblyopia and squint.

Exercises (230):

1. If the patient sees three balls consistently in vertical alignment, what does this indicate?

2. If the patient sees three balls consistently but in oblique alignment, what does this indicate?

3. If the patient sees four balls, becoming three instantly, what does this indicate?

4. If the patient sees four balls, becoming three slowly, what does this indicate?

5. If the patient sees four balls, remaining four, what does the result indicate?

6. If the patient sees two balls, what does this indicate?

231. State the purposes and characteristics of tests 4 1/2, 5, and 6, usable binocular vision, right eye, and left eye.

Tests 4 1/2, 5, and 6, Usable Binocular Vision, Right Eye, and Left Eye. Use cards DB1D, DB3D, then DB2D, each showing a railroad bridge and signboards. Set the instrument at +0.25, and tell the patient, "You see some signboards. In No. 1 (pointing) you see five white squares. And in one of these squares is a black dot." Then ask, "Is it in the right, left, top, bottom, or center square? Where is it in the other signs?" (Use the pointer.)

It will be noticed that the referential background is identical for both eyes, but that the test target, a black dot, appears only before the eye under test. This arrangement makes it possible to measure the visual response of one eye while binocular vision is maintained, as under normal working conditions. The percentage of vision demonstrated under the conditions of the test will be referred to as "usable vision." When usable vision falls materially below 100 percent, a monocular test of that eye should be made. (A blank card may be held in front of the telebinocular tube.) Record usable and monocular scores by distinguishing symbols, such as ✓ for usable and a circle for monocular. (See Keystone Cumulative Record Form No. 3A in Appendix C.)

Responses should be prompt. If the subject hesitates, indicating an effort to guess, check the last previous response as final.

The elimination of letter targets avoids the factor of recognition of familiar contours present in the use of the Snellen chart. The usable vision score *cannot* be correlated with the findings of the standard Snellen test. While the Snellen test measures the maximum of monocular acuity under occlusion, the usable vision test scores the habitual performance of each eye under fusion. The usable vision test does not necessarily elicit maximum acuity; rather, the purpose of the test is to determine whether there has been any functional loss of vision. When the response under association is lower than the monocular finding (under occlusion), the impairment may be attributed to central suppression and signifies that a visual problem exists. Table 1-4 shows Snellen equivalents for tests 4 1/2, 5, and 6 when one eye is occluded. (NOTE: Snellen equivalents on Tests 4 1/2, 5, and 6 are valid only when one eye is occluded.)

Exercises (231):

1. How do the Snellen test and the usable vision test differ?

2. What is the purpose of the usable vision test?

TABLE 1-4

SNELLEN EQUIVALENTS FOR KEYSTONE TESTS

4 1/2, 5, and 6

(Valid only when one eye is occluded.)

50% = 20/100	96% = 20/25
70% = 20/60	98% = 20/22
84% = 20/40	100% = 20/20
88% = 20/32	103% = 20/17
92% = 20/28	105% = 20/15

3. When the response under association is lower than the finding under occulsion, what does this indicate?

232. Specify particular aspects of procedures and precautions to follow when administering tests 7 through 14.

Test 7, Stereopsis at Far Point. Use card DB6D with the instrument set at +0.25. Say to the patient, "You see (pointing to each figure in the top line) a star, a square, a cross, a heart, and a ball," and ask, "Does one of them seem to be closer to you than the rest? Which one in the second line appears to be closer to you?"

Be sure that the patient understands what to look for. Give instructions slowly and clearly. Sometimes it is necessary to point out the correct character in the top line before the patient understands what is wanted. Score the last correct symbol named. If the patient sees no symbols closer than the rest, check for suppression by using the figures in the lower left and right corner of the target.

Test 8, Color-Perception Test (for Severe Defects—at Far Point. Use card DB13A, and set the instrument at +0.25. Ask the patient to read the number in the top ball and point to the number. Then ask the patient to read the number (pointing) in the lower left ball and then the number in the lower right ball. Do not permit the patient to study the target or delay too long. Score by checking the correct readings on the record form. If the patient reads both digits correctly in two balls, the score is passing. If the patient reads both digits incorrectly in two balls, the score indicates failure and severe red-green color blindness.

Test 9, Color Perception (for Mild Defects)—at Far Point. Use card DB14A, and set the instrument at +0.25. Give the patient the following instructions: "Read the number (pointing) in the top ball. Read the number (pointing) in the lower left ball. Read the number (pointing) in the lower right ball." Score by checking correct readings on the record form. Both digits incorrectly read in two balls indicates failure and mild red-green color blindness.

Test 10, Lateral Phoria Posture. Near point tests are accomplished by moving the sliding cardholder to the 2.50 near point position. For the lateral phoria test, use card DB9B and set the instrument at 2.50. The procedure and interpretation for this test are the same as for Test 3.

Test 11, Binocular Coordination. Use card DB5K, and set the instrument at 2.50. The procedure and interpretation are the same as for Test 4.

Test 12, Binocular Acuity at Nearpoint. Use card DB15, and set the instrument at 2.50. Say to the patient, "On these balls (pointing to each in center) you see lines, dots, or gray. Which of these patterns do you see, starting with No. 1 (pointing)?" It is well to tell the patient the patterns on balls 1, 2, and 3 in this manner. "Ball 1 has black dots; ball 2 is solid gray; ball 3 has black lines."

The conditions of the test are the same as in test 5; that is, the usable vision of each eye can be determined while fusion is maintained. The interpretations pertinent to test 5 are valid here. The general observations at the head of the near point section should be noted, because suppression of central fixation at the working distance may be more directly significant of the existing visual problem.

Do not hurry the patient, but at the same time do not give them too much time for study or allow them to guess. When a ball is miscalled and obviously not seen clearly, or when guessing is obvious, check the record form at this point. (NOTE: Sometimes it is well to allow the patient to proceed beyond the point where he or she misses one ball. Do not stop the patient on the first miscalled ball. If the patient can go on and give additional correct responses, allow him or her to do so until two mistakes are made successively. Then say "Tell me again what you saw on ball 6 (miscalled)." Often it will be found that the patient simply made a mistake in reporting the first miscalled ball.)

Tests 13 and 14, Usable Vision, Right and Left Eyes. Use cards DB16 and DB17, and set the instrument at 2.50. The procedure is the same as for test 12. Table 1-5 shows Snellen equivalents for tests 12, 13, and 14 when one eye is occluded.

TABLE 1–5

SNELLEN EQUIVALENTS FOR KEYSTONE TESTS

12, 13, and 14

(Valid only when one eye is occluded.)

10% = 20/200
20% = 20/100
30% = 20/67
40% = 20/50
50% = 20/40
60% = 20/33
70% = 20/28
80% = 20/25
90% = 20/22
100% = 20/20
102% = 20/18
103% = 20/17
105% = 20/15

Exercises (232):

1. What is the instrument setting for far point tests?

2. How is the patient's score on test 7 determined?

3. What is an important precaution you should take in administering test 8, as well as other tests?

4. What do tests 8 and 9 test?

5. In what position is the cardholder for near point tests?

6. In what way is test 12 similar to test 5?

233. List the disadvantages of the skills series and name an alternative procedure for specific tests.

Disadvantages There are three basic disadvantages of the skills series: (1) The tests have symbols that are appropriate for children and that are an apparent insult to the adult patient's intelligence (just what are the dog and pig *really* doing?); (2) the results of the tests for acuity must be converted to Snellen equivalents if comparisons are to be made; and (3) the form that Keystone recommends for use with this series, Doctor's Record Form 3A, is nonstandard and may easily get lost from the medical records. The cards listed in Appendix C may be ordered (local purchase) from Keystone and incorporated in your personally designed screening program.

Exercises (233):

1. What are three disadvantages of the visual skills test series?

2. What test cards may you substitute for the usable vision cards in the visual skills test series?

Additional Preliminary Tests

NOT ALL screening procedures are performed as a preliminary to a refraction. Some additional tests may be requested by another clinical service, or as an adjunct to a motor vehicle exam, college physical, or occupational physical exam.

2-1. Color Vision Testing

Three tests are given in the Air Force to determine presence or absence of color vision: the pseudoisochromatic plate set, the VTA–CTT (Vision Test Apparatus, Color Threshold Tester), and the Farnsworth Lantern (FALANT) test.

234. Define the principles of color.

Color vision does not change except in case of eye or central nervous system disease. If a satisfactory test is on record and available, the test need not be repeated on annual or other routine examinations. There is a problem, however, in determining whether or not any previous color test was satisfactory. Too often the initial color vision test was given under the wrong illumination or just "pencil-whipped," and an individual who has passed the color vision test later claims a color defect. This color defect may then disqualify the individual from a particular AFSC after specialized training has started. It may also contribute to a lawsuit resulting from a claim that the color vision was lost during service in the Air Force.

Principles of Color. In order to understand color vision testing, you must first understand the properties of color and how they are related to color vision. Since the sensation of color is related to the wavelength of the light stimulus, you also need to have a basic understanding of light, its physical characteristics, and how the human eye reacts to it.

Definition of light. Light may be considered as a form of radiant energy that behaves like a wavicle (wave-particle). The wavelength of light is the distance between any two successive crests or troughs of the wave. Figure 2-1 is a diagram of the electromagnetic spectrum showing the portion that is visible to the human eye. We cannot see radiation outside the visible spectrum because the receiving equipment in our eyes (visual receptors called cones) is tuned only to a wavelength between 380 and 760 nanometers or nm (a nanometer is one ten-millionth of a centimeter).

Physical attributes of color. Humans with normal vision when exposed to sufficiently intense electomagnetic radiation of a wavelength between 380 and 760 nm will say they see light. If the light is composed of all visible wavelengths, the observer will call it white light; if the light is composed of a relatively narrow selection of wavelengths, the observer will call it colored light. The sensation of color is closely related to three physical characteristics of the stimulus (light):

a. Hue. The hue of an object (whether it is red, green, yellow, etc.) is related to the wavelength of the light coming from the object.

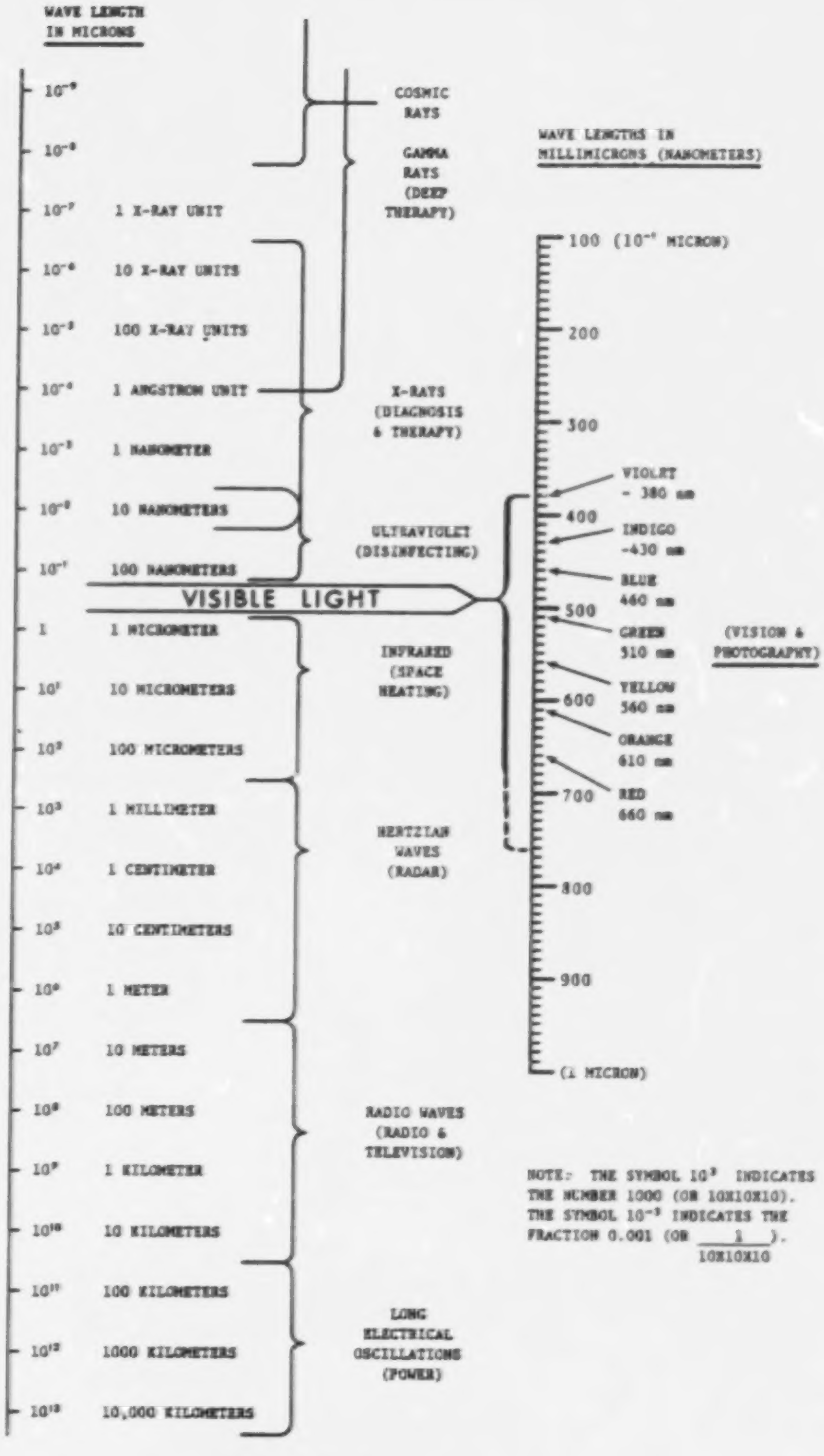
b. Saturation. Saturation refers to the purity of color—how much white light is mixed with it (for example, pink is desaturated red).

c. Brightness. Brightness is related to the rate of transfer of energy from the object to our eyes—the amplitude or amount of energy reaching our eyes.

Exercises (234):

1. Match the terms in column B with the definitions in column A.

Column A	*Column B*
_____(1) A perception of wavelengths of light within a given narrow range.	a. Wavelength.
_____(2) A combination of all visible wavelengths.	b. Visible spectrum.
_____(3) Color receiving equipment in the eyes.	c. Purity.
_____(4) The perception of rate of transfer of energy from an object to the eye.	d. Brightness.
_____(5) Distance between any two successive crests or troughs of a light wave.	e. Cones.
_____(6) The amount of white light mixed with a color.	f. White light.
_____(7) Physically means the same as saturation.	g. Colored light.
_____(8) Commonly referred to as color.	h. Light.
_____(9) Wavelengths between 380 and 760 nm.	i. Hue.
_____(10) A form of radiant energy.	j. Saturation.


WAVE LENGTH IN MICRONS
10^{-9}
10^{-8}
10^{-7} 1 X-RAY UNIT
10^{-6} 10 X-RAY UNITS
10^{-5} 100 X-RAY UNITS
10^{-4} 1 ANGSTROM UNIT
10^{-3} 1 NANOMETER
10^{-2} 10 NANOMETERS
10^{-1} 100 NANOMETERS
VISIBLE LIGHT
1 1 MICROMETER
10^{1} 10 MICROMETERS
10^{2} 100 MICROMETERS
10^{3} 1 MILLIMETER
10^{4} 1 CENTIMETER
10^{5} 10 CENTIMETERS
10^{6} 1 METER
10^{7} 10 METERS
10^{8} 100 METERS
10^{9} 1 KILOMETER
10^{10} 10 KILOMETERS
10^{11} 100 KILOMETERS
10^{12} 1000 KILOMETERS
10^{13} 10,000 KILOMETERS
COSMIC RAYS
GAMMA RAYS (DEEP THERAPY)
X-RAYS (DIAGNOSIS & THERAPY)
ULTRAVIOLET (DISINFECTING)
INFRARED (SPACE HEATING)
HERTZIAN WAVES (RADAR)
RADIO WAVES (RADIO & TELEVISION)
LONG ELECTRICAL OSCILLATIONS (POWER)
WAVE LENGTHS IN MILLIMICRONS (NANOMETERS)
100 (10^{-1} MICRON)
200
300
400
500
600
700
800
900
(1 MICRON)
VIOLET - 380 nm
INDIGO -430 nm
BLUE 460 nm
GREEN 510 nm
YELLOW 560 nm
ORANGE 610 nm
RED 660 nm
(VISION & PHOTOGRAPHY)

NOTE: THE SYMBOL 10^{3} INDICATES THE NUMBER 1000 (OR 10X10X10). THE SYMBOL 10^{-3} INDICATES THE FRACTION 0.001 (OR $\frac{1}{10X10X10}$).

Figure 2-1. The electromagnetic spectrum.

235. State the basic concepts of color vision and color blindness.

Color Matching Experiments. In order for scientists to specify a color exactly, they must describe it in terms of all three of its physical attributes—wavelengths, purity, and luminance. It's a lot easier for us common folks—we describe the sensation in easy terms, like "bright red" or "dark blue," etc. But, do all people see the same thing when exposed to the same color light? In other words, do color-normal individuals have equivalent sensations for equivalent stimuli? The answer is yes, and this can be proven with color-matching experiments with an instrument called a split-field photometer or split-field anomaloscope. This instrument consists of spectrometers that can be set to produce a specific wavelength or combination of wavelengths on one-half of a screen. The subject is then required to adjust a second bank of spectrometers to produce the same color on the second half of the same screen.

A lot of experimentation with color has shown that any perceived color can be produced by a mixture of just three specific hues—usually a certain red, blue, and yellow—and these three hues are now called primary colors. More experimentation with spectrometers has shown that most people can differentiate about 180 separate colors if hue is the only variable, and about 500,000 color sensations if both hue and saturation are varied.

Somebody got the idea of using an anomaloscope to match a monochromatic (single wavelength) light with a mixture of the three primaries. Most people got fairly consistent results. Given a certain monochromatic test light on one side of the anomaloscope, they could match it by a specific mixture on the other side; the wavelengths and relative amounts of this mixture were the same for most subjects. However, a small percentage of people made matches that made no sense at all to the color normal—the test side of the anomaloscope might appear dark red and the other side might be mixed to appear dark blue.

Scientists had known for a long time that some people *named* colors differently from other people, but most seemed to think that this was an educational problem rather than a perceptual one. Early experiments with the anomaloscope were the first proof of differences in color perception among individuals.

Color Vision Theories. You have learned some of the physical attributes necessary for a light to produce color, but how do we perceive color, and why do some people lack this ability? Let's take a look at some of the theories of color vision and see whether they can explain anything.

Young-Helmholtz trichromatic theory. Thomas Young (1773–1829) was one of the first experimenters to study color vision scientifically. He realized that the eye saw many thousands of different colors, and it would be impossible for each color to have a corresponding receptor if visual acuity were to remain at any acceptable level under colored light. Young knew that there were three primary colors and decided that this was a physiological attribute of man rather than a physical attribute of light. Young described a theory of color vision based on these premises in 1802, but it was not promulgated until 50 years later when Hermann von Helmholtz modified and published a slightly different version called the Young-Helmholtz trichromatic theory. This theory is based on a triangle with the three primary colors (either red, yellow, and blue or red, green, and violet) at each apex. If mixed in the proper proportions, either of these two sets of primaries will yield any other spectral color or white. The theory further states that there is a substance contained within each visual color receptor (cone) that is most sensitive to *one* of the primary colors. If all the substances are stimulated equally, we see white; if none of the substances is stimulated, we see black. If the substances are stimulated unequally, we see the color corresponding to the amount of each substance stimulated. A great controversy arose over the question of whether yellow was a primary or the result of a red-green mixture. (Have you ever seen a reddish green?)

Hering's theory. At about the same time that Helmholtz was expounding his theory of color vision, a Dr. Ewald Hering formulated his "theory of opposing colors." Hering stated that there are four basic colors in the spectrumd, yellow, green and blue—and that these colors are divided into pairs, the members of which always oppose each other. Red and green oppose each other and yellow and blue oppose each other. The catabolism (breakdown) of a substance contained in a cone was supposed to produce a warm color (red, yellow, or white), while the anabolism (buildup) of this substance produced the cool colors (green, blue, or black). Hering agreed that there were either three different substances or three different types of cones contained in each retina to produce these effects, but stated that there were six primary sensations (red, green, yellow, blue, white, and black). Hering's theory does not explain certain types of color blindness and assumes that the same nerve fiber can send two different sensations to the brain.

Zone theories. The most recent theories of color vision agree that light reacts on three photopigments in the eye (like the Young-Helmholtz theory), that this reaction may be antagonistic (like the Hering theory), but that there is some interaction of brightness—chromatism information—that occurs after the receptor level. These recent color vision theories are called zone theories.

Exercises (235):

1. What instrument is used to prove that color-normal individuals have the same sensations for the same stimuli?

2. What is the individual being tested required to do?

3. What is the Young-Helmholtz theory of color vision?

4. According to the Young-Helmholtz theory, what color should we see if all the substances within the cones are stimulated equally?

5. How does Hering's theory state that warm colors (red, yellow, or white) and cool colors are produced?

6. What are the most recent color vision theories called?

236. Given a list of the terms used to describe persons with abnormal color vision and descriptions of the types of abnormal vision, relate each term to its correct description.

Color Vision. The first group consists of people with normal color vision. They are said to be *trichromatic*—that is, they need a mixture of three primaries to match any other color. Further investigation found a group of trichromats who use three primaries to make a match, but use the wrong amounts—mixing a bright red to match a pink for instance. These people are called *protanomalous trichromats* (red-weak), while the people who are green-weak (use too much green to make a match) are called *deuteranomalous trichromats*. About 5.4 percent of the world population seems to have this latter problem.

The second group consists of people (2.6 percent) that need only two primaries to match any other color, and the mixtures they make with their two primaries are pretty strange to the trichromat. People who need only two primaries are called *dichromats*, and are subdivided into two types—*protanopes*, people who cannot see red, and *deuteranops*, people who cannot see green. Actually, protanopes have extreme difficulty in discriminating all the longer wavelengths of the visible spectrum—red, orange, yellow, and green appear to have the same hue! Deuteranopes, on the other hand, can see green (although they don't see it as trichromats see it), but confuse green with red, orange, and yellow.

A third group was readily evident: about 0.003 percent of the population match one-half of the anomaloscope by using *one* primary. These people are called *monochromats*. A long series of studies found that 99.5 percent of women have normal color vision, but only about 92 percent of men have normal color vision.

Exercises (236):

1. Match the following terms used to describe persons with abnormal color vision in column B with the item that most clearly describes it in column A.

Column A

______(1) Needs a mixture of two primaries to match any other color.
______(2) Needs only one primary to match any other color.
______(3) Needs three primaries to match any other color.
______(4) Needs only two primaries and cannot see red.
______(5) Needs three primaries but uses too much red.
______(6) Needs only two primaries and cannot see green.
______(7) Needs three primaries but uses too much green.

Column B

a. Trichromat.
b. Dichromat.
c. Protanope.
d. Deuteranope.
e. Protanomalous trichromat.
f. Deuteranomalous trichromat.
g. Monochromat.

237. Given a list of procedures for giving a color vision screening test, sequence the procedures in the order in which they should be performed.

Many jobs in the Air Force require normal color vision. How does the Air Force define normal color vision, and what tests are available to determine it?

Screening Test. You, as an ordinary technician, will on occasion be called on to give a color vision screening test. The standard color vision screening test is called the pseudoisochromatic plate test (PIP) and consists of one demonstration plate and 14 test plates in a ring binder. In order to insure accuracy and reliablity, use the special easel lamp for color perception testing. Both the test and the lamp are listed in the *Federal Supply Catalog*.

Procedure. The steps in giving the test are as follows:

a. Place the easel lamp on a table or shelf so that the patient's line of sight is at right angles to the plates and so that the patient's eyes are at a distance of approximately 30 inches (plates just out of arm's reach). The patient should not face an open window or other strong light. Nearby incandescent lights should be shielded so that they do not illuminate the plates. Nearby window shades should be drawn.

b. Instruct the applicant to "please read the numbers." Do not give any other instructions and do not ask other questions. Do not allow the patient to trace the patterns or touch the test plates unless he or she is a small child or otherwise illiterate.

c. Show the demonstration plate first. Then show all of the remaining 14 plates. Allow the patient about 2 seconds to respond to each plate. If the applicant hesitates, ask them again to read the number; if the applicant fails to respond, turn to the next plate without comment.

d. With the exception of the demonstration plate, which is always first, change the order of the plates frequently, particularly if there is a reason to suspect that the numbers have been learned in serial order by patients.

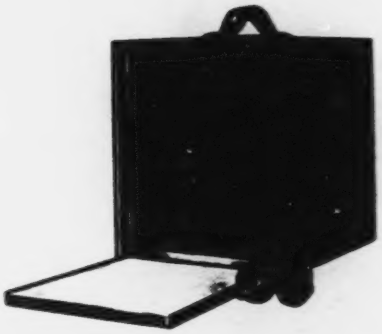


Figure 2-2. The VTA-CTT (vision test apparatus, color treshold test).

Interpretation. If 10 or more responses to the 14 test plates are correct, the patient will be considered as having normal color vision. Make the entry, "Passes—VTS-CV," in item 64, SF 88, or in the appropriate space on the eye exam form. If five or more incorrect responses are given, including failures to make responses, the patient will be considered as having deficient color vision. Enter "Fails—VTS-CV," in item 64, SF 88, with the number of *incorrect* responses.

The demonstration plate is not condsidered in scoring. In plates with two-digit numbers, incorrect responses to either is a failure for the plate.

Exercises (237):

Number the following procedures for giving a color vision screen test in the order in which they should be performed. Place the correct number of each step in the space provided.

____ 1. Ask the applicant to read each number.
____ 2. Pull down the window shades or close the curtains.
____ 3. Show the remaining 14 plates, allowing about 2 seconds for each plate.
____ 4. If the patient fails to respond, turn to the next plate.
____ 5. Show the demonstration plate.
____ 6. Place the patient so that their line of sight is at right angles to the plates.

238. Identify appropriateness of stated procedures for giving a quantitative color vision test.

Quantative Test. The quantative test is the Vision Test Apparatus, Color Threshold Tester (see fig. 2-2). The color threshold tester uses eight colors presented in a specified order at eight different levels of intensity, making a total of 64 test lights. The upper dial at the rear of the instrument controls the intensity of the test color. When in position 1, the intensity is at the lowest level; when in position 8, the intensity is at the highest level. The lower dial controls the color of the test field. Other controls are the ON-OFF switch and timer.

Procedure. The test is given in a dark room after the patient has adapted to the darkness for several minutes. Seat the patient at a distance of 10 feet from the front surface of the instrument. Turn the switch on and the timer to 30 minutes. Tell the patient that the center light is the test light and that the smaller lights on either side are guide lights to help him or her locate the test light. Make sure that the aperture stop is set at OPERATE. Instruct the patient to look midway between the two guide lights and tell him or her that red, green, blue, white, yellow, amber, and orange lights will be shown. Before starting the actual test, give a demonstration. Show the series of eight colors at the highest intensity, starting with color No. 8. You should show each for about 5 seconds and name the color to the patient. When the demonstration is completed, remind the person again to look midway between the two guide lights and to use only the names red, green, blue, white, yellow, amber, or orange. If the patient sees no light at all, he or she reports "Nothing." If the patient sees the test light but is not sure what name to give the color, he or she must guess.

In the actual test, you should present the 64 test lights as follows: set the intensity dial at No. 1 (lowest level) and show the eight colors in order from No. 1 to No. 8. Then shift the intensity disk to No. 2 and show the eight colors in order from No. 8 to No. 1. Next, shift the intensity disc to No. 3 and show the colors from No. 1 to No. 8, etc. Write the patient's answers on a special blank similar to figure 2-3, using "R" for red, etc. Do not allow the patient to change an answer after seeing the next test light.

The answers counted correct for each of the eight colors are specified at the bottom on the record blanks. Thus, red is the only correct answer for the test colors No. 1 and No. 6. Color No. 2 may be called orange, yellow, or amber. Color Nos. 3, 4, and 8 may be either blue or green. Color No. 7 may be called white or yellow. Color No. 5 may be called yellow, white, amber, or orange. A part score for each of the eight test colors is obtained by counting the correct responses, starting at the highest intensity level (No. 8) and counting to lower intensities until an error is made. Correct responses at still lower levels are *not* counted. Thus, if test color No. 1 is called red at levels 8 and 7 and amber at level 6, a score of 2 is entered for the patient's test light. Scoring may be made easier if you add each column from the bottom up. The total score is the sum of the eight part scores.

Interpretation of results. Four degrees of color discrimination are distinguished by these tests. They are defined as follows:

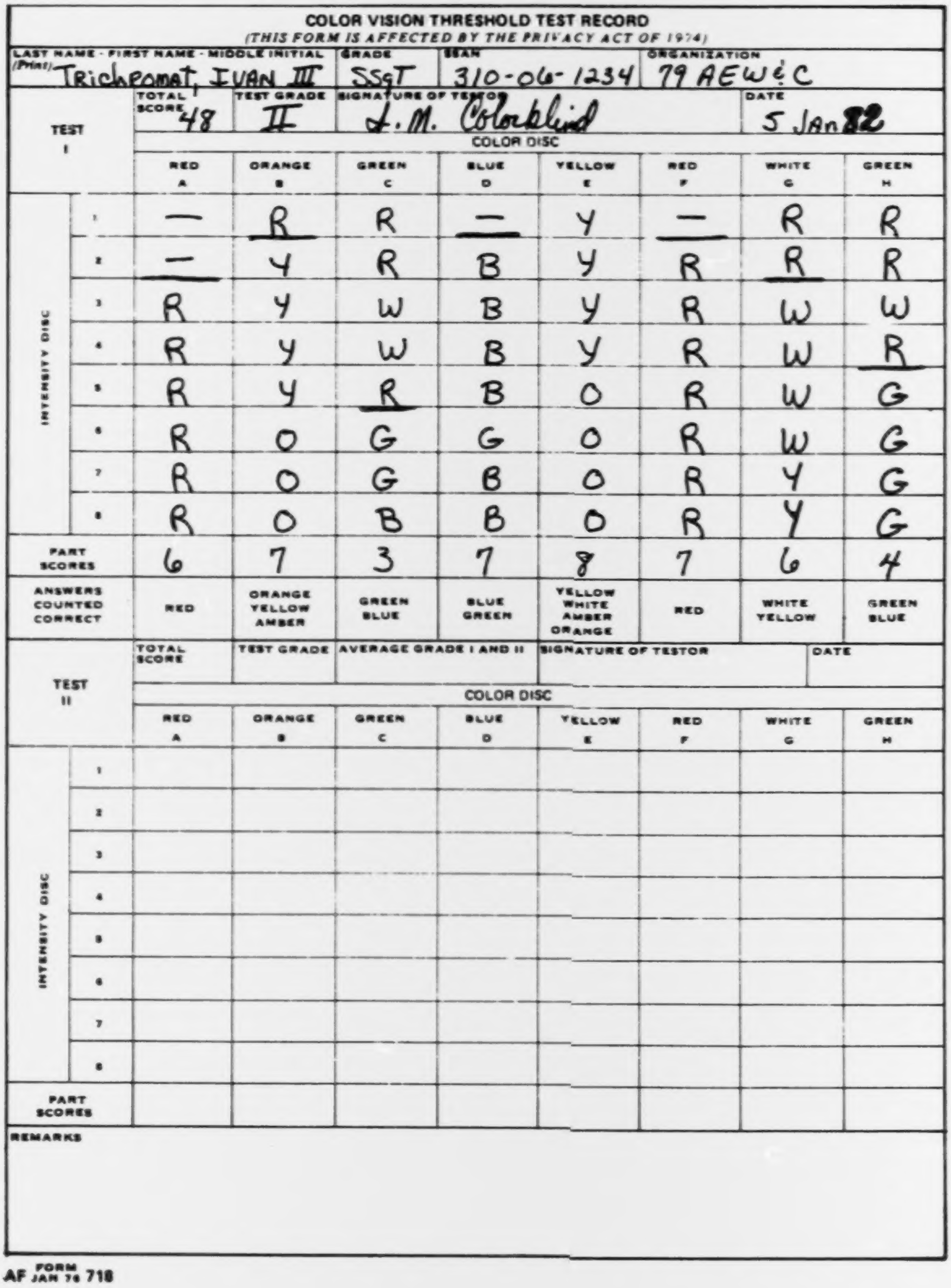
a. Normal color vision: Four or fewer errors in reading the 14 testing plates. (The quantitative test is not given if the screening test shows normal color vision.)

b. Deficient red-green color perception grade 1: Five or more errors on screening test; score 50 or better on quantitative test.

c. Deficient red-green color perception grade 2: Five or more errors on screening test; score 49-35 on quantitative test.

d. Deficient red-green color perception grade 3 (complete red-green color deficiency): Five or more errors on screening test; score 34 or less on quantitative test.

Air Force regulations have recently allowed the use of a second quantitative test if the VTA-CTT is unavailable.



COLOR VISION THRESHOLD TEST RECORD

(THIS FORM IS AFFECTED BY THE PRIVACY ACT OF 1974)

LAST NAME - FIRST NAME - MIDDLE INITIAL (Print)	GRADE	SSAN	ORGANIZATION
Trichromat, IVAN III	SSgT	310-06-1234	79 AEW&C

TEST I	TOTAL SCORE	TEST GRADE	SIGNATURE OF TESTOR	DATE
	48	II	I. M. Colorblind	5 Jan 82

TEST I	COLOR DISC							
	RED A	ORANGE B	GREEN C	BLUE D	YELLOW E	RED F	WHITE G	GREEN H
INTENSITY DISC 1	—	R	R	—	Y	—	R	R
2	—	Y	R	B	Y	R	R	R
3	R	Y	W	B	Y	R	W	W
4	R	Y	W	B	Y	R	W	R
5	R	Y	R	B	O	R	W	G
6	R	O	G	G	O	R	W	G
7	R	O	G	B	O	R	Y	G
8	R	O	B	B	O	R	Y	G
PART SCORES	6	7	3	7	8	7	6	4
ANSWERS COUNTED CORRECT	RED	ORANGE YELLOW AMBER	GREEN BLUE	BLUE GREEN	YELLOW WHITE AMBER ORANGE	RED	WHITE YELLOW	GREEN BLUE

TEST II	TOTAL SCORE	TEST GRADE	AVERAGE GRADE I AND II	SIGNATURE OF TESTOR	DATE

TEST II	COLOR DISC							
	RED A	ORANGE B	GREEN C	BLUE D	YELLOW E	RED F	WHITE G	GREEN H
INTENSITY DISC 1								
2								
3								
4								
5								
6								
7								
8								
PART SCORES								

REMARKS

AF FORM JAN 76 718

Figure 2-3. Sample VTA-CTT record form.

This test is the Fransworth Lantern (FALANT) (fig. 2-4), and is much easier to administer than the VTA–CTT. Instructions for administering the test are printed on the instrument case. The instrument tests color vision under normal room lights by presenting a series of test colors to the patient. The test colors are designed to look like distant signal lights, one color above another. The patient is instructed to sit or stand 8 feet from the instrument and name the colors, calling out the top color of a pair first. The examiner starts the test by exposing a red over green or green over red combination (combination 1 or 5), and then randomly exposes the remaining eight test lights. Passing score is 9 correct answers out of 9 exposures. If an error is made on the first run, the examiner will disregard that run and repeat the test twice. Final score will be the average of the last two runs. If the average error for these last two runs is one or more per run, the patient fails the test.

Confirmation of deficient color vision. When deficient color vision has been established in an individual, the screening test need not be repeated in subsequent examinations, since congenital color blindness is unchanged throughout life. Acquired defects in color discrimination will be confirmed by tests of visual acuity or visual fields. The degree of deficiency in color perception, when congenital, is likewise unchanged throughout life. Minor fluctuations in the score on the quantitative test do, however, occur because of chance factors. Therefore, when the VTA–CTT score is within three points of the critical scores for grades 1, 2, and 3, the test should be repeated, and the classification of degree of defect based on the average (not the highest) score of two or more independent tests. Otherwise, repetition of the color vision test at regular intervals is unnecessary.

Exercises (238):

Identify each true statement and explain why the others are false.

____ 1. The patient is seated at a distance of 30 inches from the instrument.

____ 2. Tell the patient that the center light is the test light.

____ 3. In the demonstration test, the patient names eight colors.

____ 4. The patient must guess the color if they are not sure what name to give it.

____ 5. To obtain a part score, count all the correct responses.

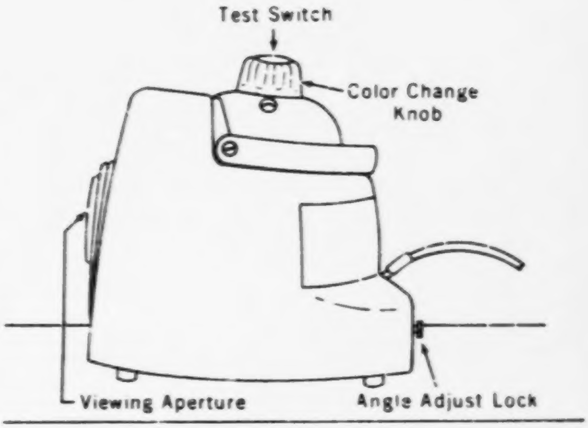


Figure 2-4. Farnsworth Lantern.

____ 6. The color vision test is repeated if the individual comes within 10 points of the passing score for grades 1, 2, or 3.

____ 7. When the Farnsworth Lantern test is administered, the patient sits or stands in a dark room 8 feet from the instrument.

____ 8. It is not necessary to repeat the screening test in subsequent examinations if deficient color vision has been established in an individual.

2-2. Night Vision Testing

The visual acuity tests described in Chapter 1 were all designed to test acuity under normal light levels of about 1 or 2 log millilamberts, but not all of our seeing is done under light conditions as bright as this. What happens to our vision under dim light conditions, and how can we measure it?

239. Define terms relating to the physiology of night vision and compare scotopic and photopic vision by specifying particular characteristics of each.

Physiology of Night Vision. The retina, or nervous tunic (coat or covering) of the human eye is composed of visual receptors called rods and cones. These rods and cones, stimulated by light, send electrochemical signals down a complicated neural pathway to the vision center in the brain. Cones are located mainly in a retinal area called the macula, and rods are more predominant outside the macula area. There is a small area inside the macula, about

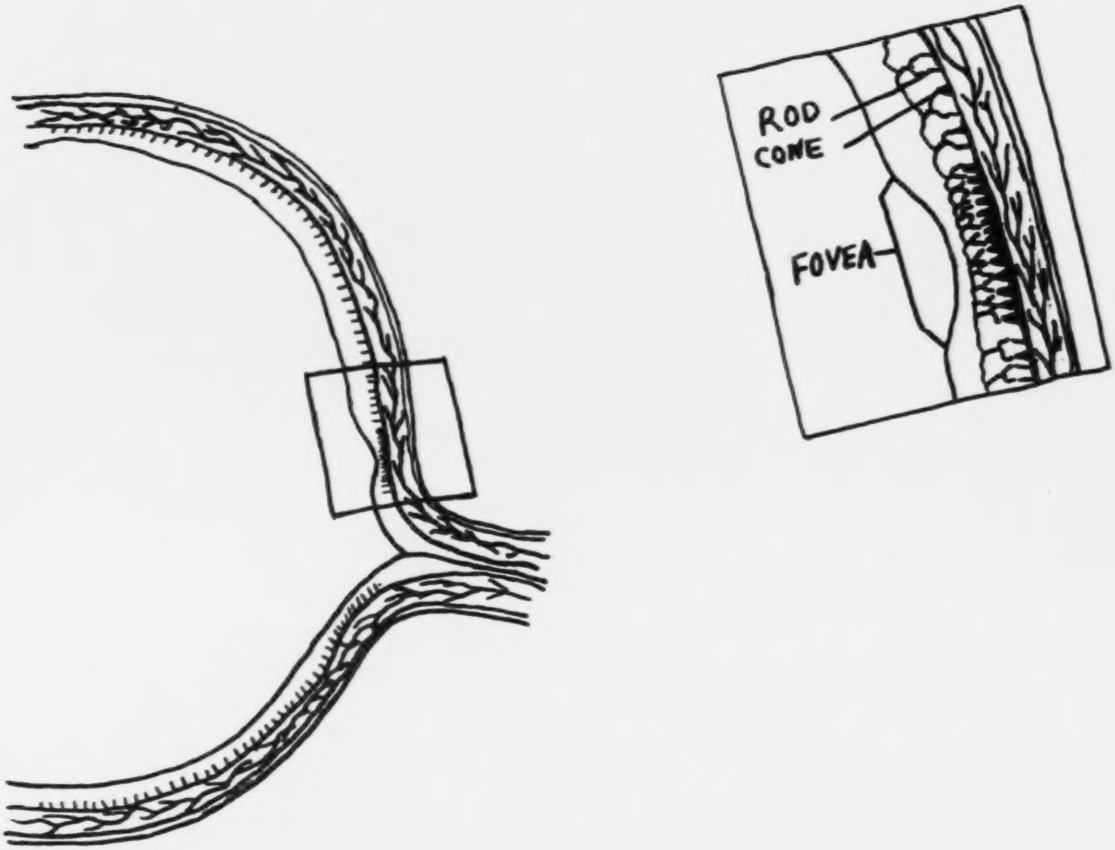


Figure 2–5. Section of the human eye showing rod-free fovea.

2? in diameter, called the fovea. The fovea has no rods whatsoever (see fig. 2-5). Why do we have two types of visual receptors, and what is the significance of the anatomical placement of these receptors? Experimenters have found that cones are hooked up to the neural pathway in such a manner that they transmit a very fine-grained picture, but they need appreciable light levels to operate. Rods, on the other hand, give a coarse-grained picture to our brain, but need very little light to work. Vision under light levels appropriate to cones is called *photopic vision*; vision under light levels appropriate to rods is called *scotopic vision*. When both rods and cones are used (under moderately dim light), the term is *mesopic vision*. Due to the anatomical placement of the rods in the retina, scotopic vision has a 2° central blind spot, and therefore visual acuity is about 20/200 to 20/400. Due to the lack of certain chemicals in rods, scotopic vision is totally colorblind. Cones are most sensitive to a yellow-green light of about 555 nm, while rods are most sensitive to a greenish-blue light of about 508 nm. This is one of the reasons why blues seem to become brighter and reds seem to become dimmer as light levels decrease. Rods are insensitive to reds with a wavelength of 600 nm or longer. This is why red goggles are often used to "dark adapt" eyes.

Exercises (239):

1. In exercises 1 through 7, match the terms in column B with the definitions in column A.

Column A

_____ (1) The nervous tunic of the human eye.
_____ (2) Vision under light levels that can be received by cones.
_____ (3) Visual receptors located in the macula.
_____ (4) Vision under light levels that can be received by rods.
_____ (5) Visual receptors located outside the macula.
_____ (6) Vision under light levels that can be received by both cones and rods.
_____ (7) Area of the retina having no rods.

Column B

a. Cones.
b. Rods.
c. Retina.
d. Photopic vision.
e. Scotopic vision.
f. Mesopic vision.
g. Fovea.

2. What region of the visual field is sent to the brain by cones?

3. What region of the vision field is sent to the brain by rods?

4. Describe the picture sent to the brain by cones.

5. Describe the picture sent to the brain by rods.

6. Compare rods and cones as related to color vision.

7. What is the approximate visual acuity under scotopic vision?

2-3. Stereopsis and Depth Perception

In flying, driving, and many other activities involving visual cues, the ability to perceive depth is of great importance. An individual can determine the relative distance of objects by using at least eight cues directly related to vision.

240. Name the instruments used in, and the physiology of depth perception testing, and define the eight cues directly related to depth perception.

Cues Related to Depth Perception. Listed below are eight signals, or cues, that the eyes send to the vision center in the brain. These cues enable the brain to interpret what the eyes see with reference to depth perception.

(1) Overlap. If an object overlaps another object, the overlapping object is closer.

(2) Relative size. Objects seen as being larger are usually closer.

(3) Perspective. This is also an important cue; two-dimensional drawings and photographs give the illusion of depth by proper use of perspective.

(4) Distance haze. An object located in the far distance is partially obscured by haze.

(5) Parallax. This term applies to the relative change in postion of an object with movement of the observer.

(6) Convergence. Near objects may be judged as to relative depth by the brain measuring the amount of convergence of the eyes needed to maintain single binocular vision when looking at each object.

(7) Accommodation. The amount of accommodation needed to keep each object clear may also be a cue.

(8) Stereopsis. The last cue, and perhaps the most important to fine depth discrimination at medium to near distances, is stereopsis. Since the eyes are located a little way apart, an object will have an image on a slightly different place on each retina in relation to other objects in the visual field. This retinal displacement is interpreted by the brain as a difference in depth.

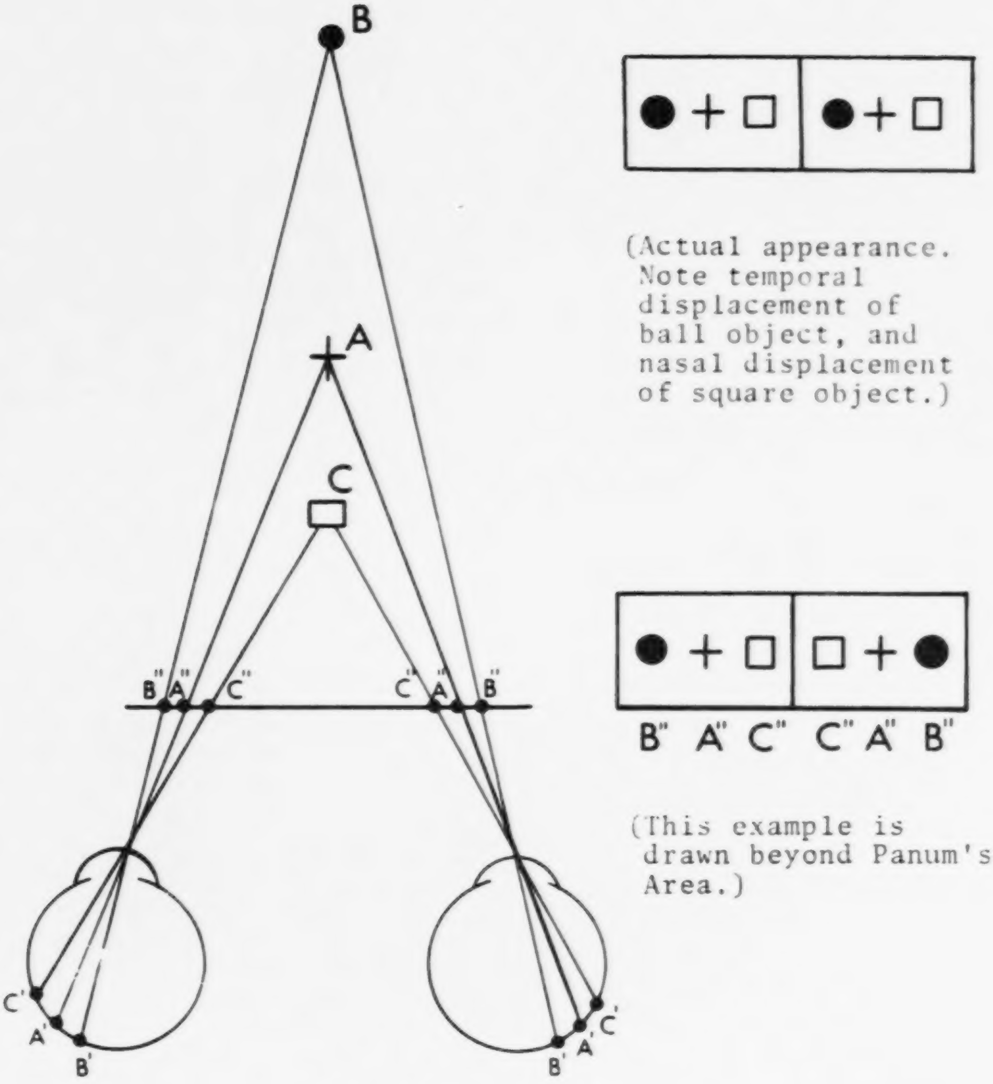
All clinical depth perception tests measure stereopsis and attempt to eliminate the presence of other cues. The Verhoeff Stereoptor uses an actual difference in depth of test rods to achieve this, while the VTA–ND and Keystone instruments use special photographs with one portion of the target line displaced laterally to simulate depth. Stereopsis is a primary cue to depth perception, while the other cues are secondary. You may wonder how a flat photograph can give the impression of depth. In order to understand this, look at figure 2-6. Assume that you are looking at an object A. The image of this object falls on each fovea at point A'. The image of an object B falls on the retina at point B', which is nasal to the fovea. The image of an object C falls on the retina at point C', which is temporal to the fovea. If B or C are too far from A, you will experience double vision (dipolpia) and see two Bs or two Cs, but if the objects are close enough so that their images (A', B', and C') fall inside a retinal area called Panum's area, you will see only one of each object, but B will appear displaced behind A, and C will appear displaced in front of A. If we trace the light from A, B, and C to the eyes, and make a special drawing or picture of the relative displacements of these light rays, we arrive at a picture similar to the one to the right of the figure. If this picture is viewed in a stereoscope, the light paths are duplicated as if in real life and object B appears far away, while object C appears close.

Exercises (241):

1. What is the primary cue to depth perception?

2. What are three instruments used to measure depth perception?

3. If one image falls too far from the other, what will you experience?



(Actual appearance. Note temporal displacement of ball object, and nasal displacement of square object.)

(This example is drawn beyond Panum's Area.)

Figure 2–6. Stereopsis by retinal displacement.

4. Match the items in column B with the item in column A that most nearly describes it.

Column A

_____(1) Objects that are close appear larger.

_____(2) Ability of the eyes to cross in order to maintain single binocular vision.

_____(3) An object in the distance appears indistinct.

_____(4) This cue is used in drawings to give the illusion of depth.

Column B

a. Stereopsis.
b. Convergence.
c. Accomodation.
d. Relative size.
e. Overlay.
f. Parallax.
g. Perspective.
h. Distance haze.

Column A

_____(5) Because of the distance between the eyes, the images on the retinas are slightly different.

_____(6) When objects overlap, the object that can be completely seen is the nearer to the viewer.

241. Specify particulars about the operation of and the conditions required for the use of the depth perception testing instruments.

Depth Perception Tests. There are several types of depth perception apparatuses used in the Air Force. One of the oldest is the Howard-Dolman peg and string test, which you may have seen in the movies. A quicker test is the Verhoeff Stereoptor Depth Perception Apparatus. As mentioned before, the VTA-ND and Keystone units also have stereopsis tests. The Howard-Dolman and Verhoeff tests are based on actual depth differences, while the VTA-ND and Keystone units are based on apparent depth induced by lateral image displacement. The polaroid Stereo Fly used in some clinics is also based on the principle of retinal image displacement.

Testing of depth perception using the VTA-ND will be considered the standard test. However, when the machine vision tester is not available, or if the patient fails the standard test, the Verhoeff depth perception apparatus or the Howard-Dolman apparatus is acceptable. Applicants for pilot training must not wear corrective lenses while these tests are being performed; however, other patients should wear their best correction.

Exercises (241):

1. What is the difference in the way the Howard-Dolman and Keystone tests work?

2. What is the standard apparatus used to test depth perception in the AF?

3. List two conditions under which the Verhoeff apparatus or Howard-Dolman apparatus may be used.

4. What special condition for taking the depth perception test applies to applicants for pilot training?

242. Given hypothetical results of the fusion test, determine from patient's answers whether they have normal or abnormal binocular vision and, if abnormal, whether it is compensated by suppression.

Two stereo tests are given using the VTA-ND apparatus: the fusion test and the depth test. The depth test is not given if the patient fails the fusion test.

Fusion Test. Before giving this test, make sure that the occluder is in the midposition and the prism control handles are in the scoring position. The purpose of this test is to determine whether the slightly different test targets presented to the right and to the left eye are combined into a single image; whether they are seen double, that is, side by side or one above the other; or whether the target presented to one eye is not seen.

If the patient has normal binocular (two eyed) vision, he or she will see at the left of the slide a single arrow with both a head and a tail. To make sure that the patient actually has normal binocular vision, ask him or her to describe what the arrow seen, and check the answers by covering one of the eyes with the occluder. When the right eye is covered, the tail of the arrow should disappear. When the left eye is covered, the head of the arrow should disappear. If either of the following abnormal answers is given when the patient is allowed to use both eyes (occluder not over either eye), count the fusion test as failed:

a. Double vision. The patient reports seeing two arrows, side by side, or two circles, one above the other. Before failing the patient, check to see that prisms are in scoring position.

b. Suppression. When allowed to use both eyes, the patient sees only the head or only the tail of the arrow.

Exercises (242):

1. In each of the following exercises, match the patient's answer in column A with the type of vision in column B. Each column B item may be used once or more than once.

Column A

_____(1) Using both eyes, the patient sees a single arrow with both a head and a tail.
_____(2) Using both eyes, the patient sees two arrows.
_____(3) Using both eyes, the patient sees only the head of the arrow.
_____(4) Using both eyes, the patient sees only the tail of the arrow.

Column B

a. Normal binocular vision.
b. Suppression of the right eye.
c. Suppression of the left eye.
d. Double vision with no suppression.

243. State the procedures for giving the VTA-ND depth test.

Depth Test. This test should be omitted if the patient fails the fusion test—that is, if the patient exhibits either double vision or suppression. It should also be omitted if the patient's score is 0, 1, 2, 3, or 4 on the far-acuity test in either eye. A score of "X" will be given if the depth test is omitted.

Of the entire battery of tests, the one for depth perception is the most difficult to give and interpret. This is, in part, because patients who have normal perception of depth in situations to which they are accustomed may have to *learn* to see the apparent depth employed in this test. Consequently, although good scores can be accepted as evidence of normal binocular vision and normal depth perception, even complete failure on this test, unless supported by other evidence, is not necessarily indicative of poor depth perception. Therefore, to reduce to a minimum the number of false failures, do not hurry through the demonstration and the practice period that precedes the actual test. The depth slide used to test depth perception consists of a number of horizontal rows of circles, five circles in each row, one of which should appear slightly nearer to the patient than the other four.

To explain the test, first show the patient a demonstration device consisting of a transparent plastic plate with four black circles on the rear surface and one on the front. As in the depth-perception test itself, one circle appears nearer than the other four. After the plastic demonstration model of the test has been shown, tell the patient to look into the instrument and direct his or her attention to group A, the three rows of circles in the upper left-hand corner of the square. Use the first group to further explain the test and allow time for the perception of depth to develop. The top row of five circles in group A demonstrates a relatively large difference in depth, the middle row a moderate difference, and the bottom row a small difference. Some patients may not see any depth for the first minute or so, and in such cases, you should not hurry through the practice test. You may tell patients the correct answers for the three rows of group A, and instruct them to look at each circle in turn until they can see that one of the five circles in each row is nearer to them than the others.

You may use the occluder to demonstrate that with monocular (one-eyed) vision all the circles appear in the same plane, while with binocular (two-eyed) vision, one may appear nearer than the other four. When you are satisifed that the patient actually sees depth in at least the top row, you may proceed to the actual test. Do not give any help or hints such as those used in the practice period. Ask the patient to indicate by number, counting from left to right, which circle is nearer in the top, the middle, and the bottom rows of group B. If all three answers are correct, ask the same questions for group C, group D, etc. Discontinue the test when the patient gives one or more incorrect answers in any one group beyond group B. (If the patient gives one or more incorrect answers in group B, repeat the practice session with group A; then have the patient try group B again, followed by group C, etc., if the patient now gives correct answers in group B.) The score is the letter of the last group in which there are no errors. If the patient fails the first test group B a second time, record the score as "0."

Exercises (243):

1. If the patient fails the fusion test, what should you do?

2. What should you do if the patient's score on the far-acuity test in either eye is 0, 1, 2, 3, or 4?

3. To reduce to a minimum the number of false failures, what should you *not* do?

4. To further explain the test, what should you use as a practice test?

5. When should you proceed to the actual test?

6. How must the patient indicate which circle is nearest in the top, the middle, and the bottom rows of each group?

7. How is the score of the test represented?

244. State the procedures for giving the Verhoeff depth perception test.

Verhoeff Depth Perception Test. This binocular test is given with the Verhoeff Portable Depth Perception Apparatus (DPA–V). (See fig. 2-7.) The apparatus provides for the shifting of the relative position of three vertical rods. One rod is always nearer to, or farther away from the patient than the other two. Show one or two positions to the patient at close range to demonstrate clearly that one rod is always closer or farther than the other two. Also, explain that the size of the rods is not a clue to the relative distances. Eight different rod relations are possible by showing four and then reversing the instrument for four more. All eight positions will be used in this examination.

The test distance is 1 meter between the examiner and the patient. Keep the device centered on a frontal plane normal to the subject's binocular vision midline. To avoid helpful extraneous cues, you should hold the device steady and not rotate it on its vertical axis. Moreover, do not permit the patient to move his or her head. You should not expose the target window while you are placing the device in position or while you are changing the sets. A convenient method of manipulation is to grasp the device over the target window with your left hand, place the desired set into position with your right hand, then grasp the target window by moving your left hand up or down. Thus, while the target window is exposed, you support the device with both hands.

The patient should answer each of the eight presentations correctly. If an error is made on the first run, make two more runs, and the patient must report eight out of eight correctly on both trials. If this is not done, the patient fails the examination. Report the score as "Passes" or "Fails."

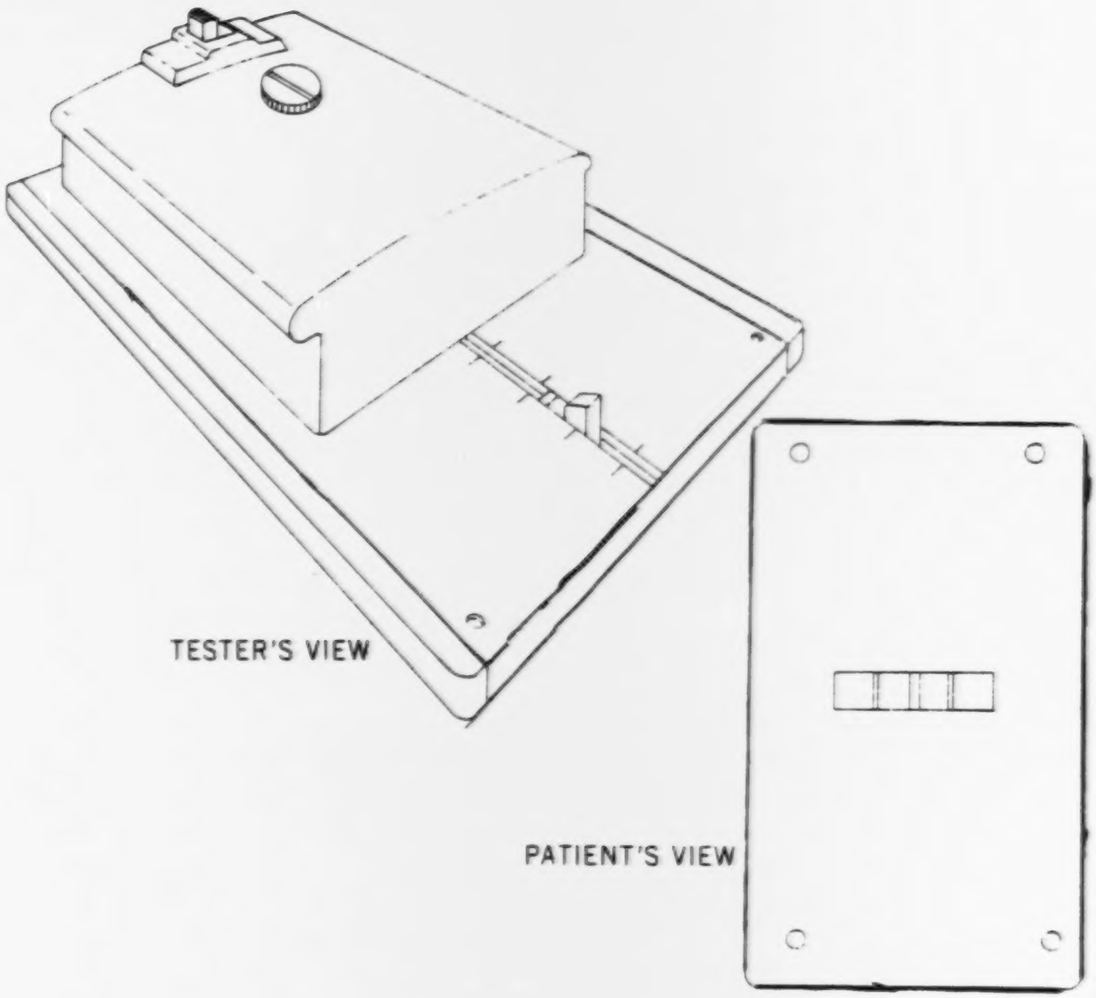


Figure 2-7. The Verhoeff device.

Exercises (244):

1. How do the Verhoeff device test depth perception?

2. How do you demonstrate to the patient that one rod is always closer or farther than the other two?

3. How should you keep from giving the patient any extraneous cues?

4. To pass the test, how many correct answers out of eight possible must the patient get?

5. How many times is the patient allowed to repeat the test?

6. What should be the distance between the examiner and patient?

245. State the procedures for administering the Howard-Dolman depth perception test.

Howard-Dolman Depth Perception Test. The Howard-Dolman test consists of a box holding one stationary and one movable rod. The movable rod is connected to a long string or cord with which the patient can adjust the rod back and forth until it appears to be just as far away as the stationary one. A small ruler attached to the stationary rod shows the actual difference in depth.

Administer this test at a distance of 20 feet. Make at least five readings. If these are abnormal or widely variable, make 10 readings. If the patient wears corrective lenses while flying, repeat the examination with the patient wearing the proper correction for distance. Record the average obtained with correction (if allowed) and the average obtained without correction in millimeters from the 0 position. Explain the working of the apparatus to the patient. Then place the movable rod well away from the fixed rod while screening them from the patient. Step aside, pass the cords to the patient, and direct the patient to adjust the rods to an equidistant position. The following precautions should be taken:

(1) Do not permit the patient to move his or her head while adjusting the rod.

(2) The cord should have no means of position reference, such as knots and frayed areas.

(3) Do not permit the patient to draw the movable rod from end to end of the box.

(4) Remove the cord from the patient's hands and screen the rods from the patient's view while you readjust them.

Exercises (245):

Check your knowledge of the procedures for giving the Howard-Dolman test by marking each true statement and explain why the others are false.

____ 1. The test is done at a 20-foot distance.

____ 2. Ordinarily, 10 readings are made.

____ 3. The patient should not wear their corrective lens when the test is done.

____ 4. The testing apparatus uses one fixed rod and one moveable rod.

____ 5. The patient tries to adjust the movable rod so that it is the same distance away as the fixed rod.

____ 6. There are no special precautions to take if the test is to be valid.

246. State the procedures for administering the Titmus Stereo Fly depth perception test.

Titmus Stereo Fly Depth Perception Test. The Titmus Stereo Fly test is another method for checking depth perception. It can be used on adults but is more frequently used on children. The standard Stereo Fly test set consists of three items: the test booklet, a pair of polarized glasses, and the directions for use.

The testing procedures are rather simple. Have the patient sit in a comfortable chair and hold the booklet 16 inches away in reading position. Have the patient put on the polarized glasses. If the patient wears a habitual near prescription then the polarized glasses go right over them. The room lighting should be at a normal level, while taking care not to have any glare directly on the booklet.

When the patient opens the test booklet, the first thing seen will be a big housefly. The wings should stand out so that the patient, when asked to, can pinch the fly's wing. Normally the patient will pinch about an inch or so above the wing. If the patient pinches down on the booklet, this tells you that he or she has poor depth perception and you should check for suppression. The booklet is prepared to do this. At the bottom of the picture of the fly, in the right corner, is a circled "R" and on the left is a square with an "L." Ask your patient if both can be seen. If the patient can only see one of them then he or she is suppressing, and you might as well stop testing.

Let's say the patient did fine on the fly. Ask the patient to look at the left page. Here he or she will see sets of animals and sets of circles in a diamond pattern. The circles are used for adults and the animals are used for children. The adults will be asked to pick out the circles that appear closest to them. Continue through the circles until the patient makes a mistake. The scoring directions are found with the booklet. Scores are in seconds of arc; annotate on the patients record "Titmus Stereo Fly test ____________ sec. of arc." Keep in mind that this test can't be used for military physicals but is good for driver's license tests and general screenings.

Exercises (246):

Check your knowledge of the Titmus Stereo Fly test by identifying each true statement and explain why the others are false.

____ 1. The test is done at a reading distance of about 16 inches.

____ 2. The patient is not allowed to wear habitual near prescription.

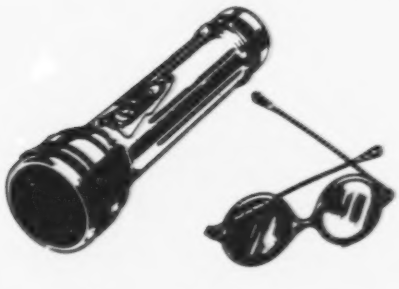


Figure 2-8. Worth 4-Dot test.

____ 3. The test is used only for adults.

____ 4. The test can be used for driver's license testing.

2-4. Fusion Testing

You should have noted that a prerequisite for the stereopsis test in the previous unit is the presence of fusion. In addition to the fusion tests given before depth perception tests, there exists a battery of fusion tests designed to determine any muscular anomaly or visuosensory anomaly that may be present. The Near Point of Convergence Test (PC), a method of determining the limits of fusion, was described in Chapter 1. In this section, we will describe two additional tests, the Worth 4-Dot Test and the Red Lens Test.

247. State how the human visual system reacts to diplopia, and cite the causes of suppression.

Diplopia. Because diplopia, or double vision, is an antisurvival characteristic, the human visual system must eliminate it. There are two ways for it to eliminate diplopia: (1) it can either put the two images together (fusion), or (2) it can turn one of the images off (suppression). You have already learned (in Chapter 1) that suppression is one of the causes of ambliopia. The causes of suppression may vary from diplopia to aniseikonia (unequal retinal image sizes) to unequal refractive errors. The tests described in this section are designed to help detect diplopia and suppression.

Exercises (247):

1. List and briefly explain the two ways in which the human visual system reacts to diplopia.

2. Name three causes of suppression.

248. Given specific hypothetical results of the Worth 4-Dot Test, interpret them as to the presence or absence of diplopia, with or without suppression.

Worth 4-Dot Test. The Worth 4-Dot Test (see fig. 2-8) may be performed at near point (or far point using the Projectochart). It is designed to detect suppression or diplopia when the patient is looking, either directly *at* the target *or* in a direction *other* than straight ahead.

The test consists of four lighted spots or dots arranged in a baseball-diamond pattern (see fig. 2-9). Home plate is white, first and third bases are green, and second base is red. The patient wears anaglyph glasses (special colored filters—green lens over the left eye and red lens over the right eye). The right eye can see only the white dot (as red) and the red dot. The left eye sees the white dot (as green) and the two green dots. A person with normal muscle balance and binocular vision sees the four dots just as they would without glasses. If one eye suppresses, the individual sees only *three* or *two* dots, which are the color of the lens on the nonsuppressing eye. If a high phoria or tropia is present without suppression, the patient sees *five* dots, the pattern depends on the type of diplopia and muscle imbalance. Uncrossed diplopia (green dots seen to the left of the red) indicates an eso condition. Crossed diplopia (green dots seen to the right of the red) indicates an exo condition. Normal color vision is *not* necessary for this test.

No item is denoted for this test on SF 88, but many local forms may have an entry entitled "4-Dot." If you are instructed to perform this test, and the form used in your clinic is a DD Form 741, Eye Consultation, enter your findings on the back side of the form.

Exercises (248):

1. Match the following visual conditions in column B with the test result in column A that most nearly relates to it.

Column A	*Column B*
______(1) Patient sees three dots.	a. Normal vision (no diplopia).
______(2) Patient sees five dots, with green dots to the left of the red.	b. Suppression of left eye.
______(3) Patient sees four dots.	c. Suppression of right eye.
______(4) Patient sees five dots, with the green dots to the right of the red.	d. Uncrossed diplopia without suppression, eso condition.
______(5) Patient sees two dots.	e. Crossed diplopia without suppression, exo condition.

249. Given specific hypothetical results of the Red Lens Test, interpret them as to the presence or absence of diplopia, either with or without suppression.

Red Lens Test. The Red Lens test is routinely performed for flying physicals only. This test is designed to

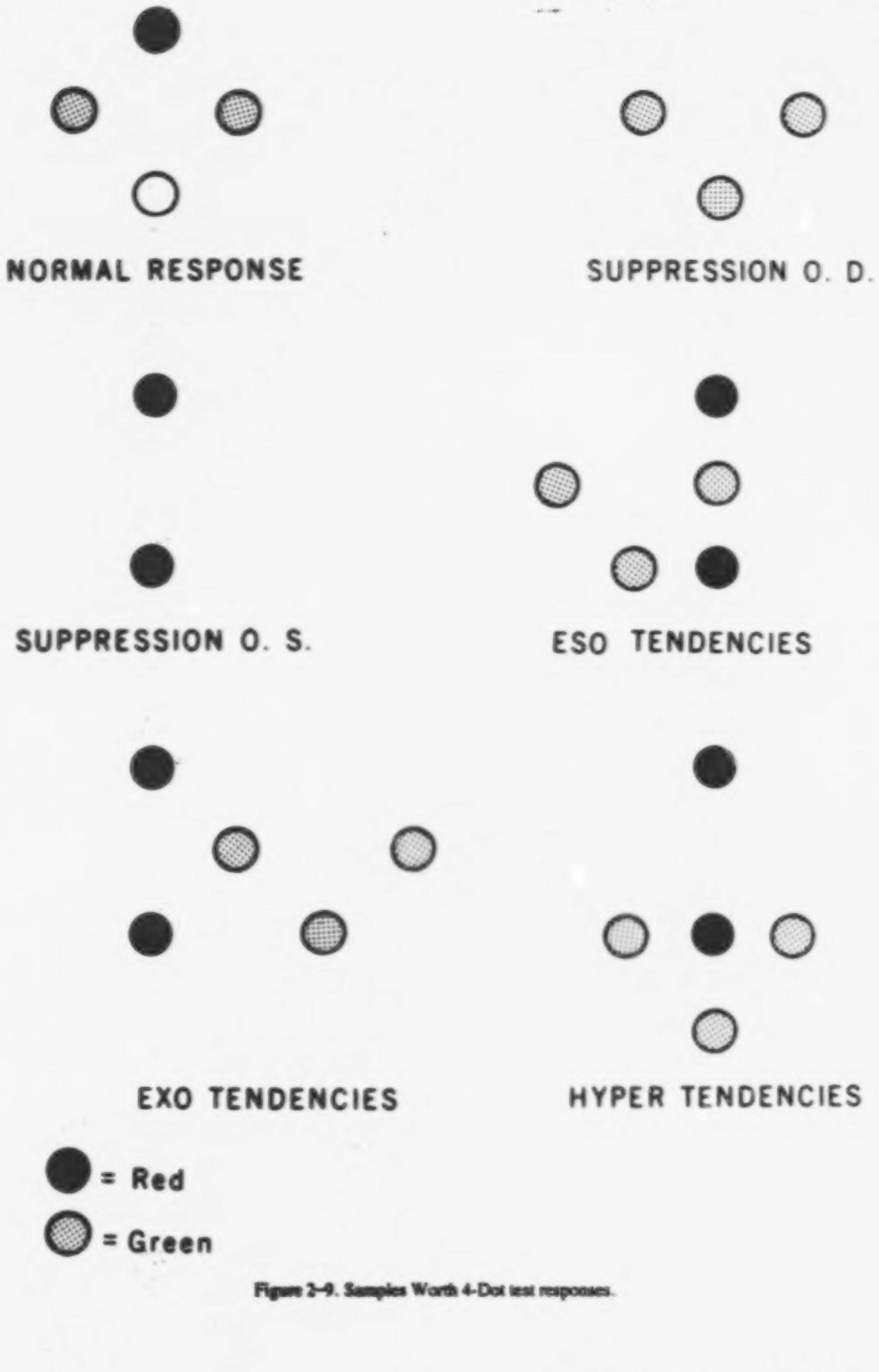

NORMAL RESPONSE
SUPPRESSION O. D.
SUPPRESSION O. S.
ESO TENDENCIES
EXO TENDENCIES
HYPER TENDENCIES
● = Red
○ = Green

Figure 2-9. Samples Worth 4-Dot test responses.

detect diplopia (double vision) when the patient is looking in a direction other than straight ahead.

Place the special red lens before the patient's right eye. Use of the red lens in the standard trial case is unsatisfactory because of its small size and dark color. Place a tangent screen 30 inches from the patient, or as an alternate, use a central fixation point. Such fixation point should be 48 inches from the floor on a plain wall with intersecting lines at 45°, 90°, 135°, and 180° running at least 20 inches from the point of fixation. Mark the lines at 4-inch intervals and fasten a cord 30 inches long at the fixation point to determine testing distance. The back of the roller-type tangent screen may be used. The patient's eyes should be on an exact line perpendicular to the fixation point so that the head and eyes are not tilted in any direction. The patient should be seated on an adjustable stool, and the head steadied by placing the chin on a chinrest so that the visual axis will not be altered during testing. Then move a point of light outward in the six cardinal directions from the center of the screen: right, left, up and to the right, up and to the left, down and to the right, and down and to the left. Instruct the patient to follow the light with the eyes without moving the head and to report either a change in the color of the light (suppression), or a doubling of the light (diplopia). At the beginning of the test, demonstrate change in the color of the light by use of the occluder, showing that the light may be either red, white, or pink.

Exercises (249):

1. Match the condition in column B with the test result in column A that most nearly identifies it. Each condition in column B may be used once or more than once.

Column A	*Column B*
_____ (1) Patient sees both red and white lights.	a. Suppression of left eye.
_____ (2) Patient sees pink light.	b. Diplopia, without suppression.
_____ (3) Patient sees only red light.	c. Normal vision.
_____ (4) Patient sees only white light.	d. Suppression of the right eye.

2. Identify each true statement concerning administration of the Red Lens test and explain why the others are false.

____ a. In this test, the patient always looks straight ahead.

____ b. Because the standard red lens is unsatisfactory, a special red lens should be used.

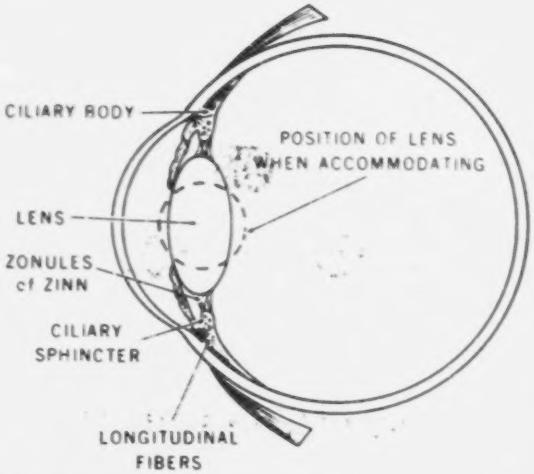


Figure 2-10. The accommodation (intraocular) muscles and the change in shape of the lens during accommodation.

____ c. You should instruct the patient to follow the light with the eyes.

____ d. A change in the color of the light indicates diplopia.

2-5. Accomodation Testing

A final preliminary test which is designed to detect reading difficulty problems is the near point of accommodation.

250. Given a list of terms concerning accommodation testing, relate each to its correct definition or description, and state the basic procedures in administering the test.

Physiology of Accommodation. Accommodation may be defined as the function whereby the (+) or converging power of the eye is increased so that the focus of light remains on the retina even though the object is at such a distance that the light reaching the eye has a (−) or diverging waveform.

The crystalline lens in each of our eyes is a flexible, clear piece of tissue. It is surrounded by a ring-shaped muscle called the ciliary sphincter (fig. 2-10). In the relaxed or unaccommodated eye, the ciliary sphincter is enlarged by the longitudinal and radial fibers, causing tension on the Zonules of Zinn, thus stretching the lens into an ellipsoidal shape. When the ciliary sphincter circular fibers are stimulated, it constricts, relaxing the tension on the zonules and allowing the lens to assume a more spherical shape.

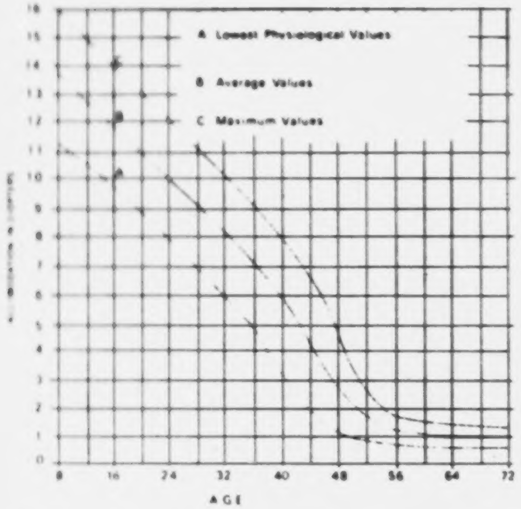


Figure 2-11. Amplitude of accommodation for various age groups.

This increased sphericity increases the effective dioptric power of the eye and increases the convergence of light within the eye. The stimulus to accommodation is a blurring of the retinal image, usually caused by insufficient vergence of light. In simple terms, if an object is brought close to the eyes, the effective negative wavepower of the light striking the retina is increased, causing a reflex attempt to increase the positive power of the lens, thus keeping the image clear.

Amplitude of accommodation. The maximum amount of accommodation that the eye can produce is called the amplitude of accommodation. This is measured by measuring the distance from the test object to the eye and converting it to diopters. Amplitude of accommodation may be influenced by many things, but the most important factor is age.

Presbyopia. Most theorists agree that the accommodative amplitude of infants is extremely high. Accurate measurements have shown that the average amplitude of accommodation of 10-year-olds is about 14.00 D. At age 70, the amplitude has dropped to 0.25 D. When an individual reaches an age where he or she can no longer accommodate for his or her reading distance, that individual is said to have become *presbyopic* (a presbyope). Usually, presbyopia has its onset about age 40. The correction for presbyopia involves replacing the "lost" (+) power of the eye by substituting spectacles or reading glasses. Figure 2-11 shows the decline in accommodative amplitude with age; presbyopia will advance whether or not the patient wears glasses, therefore, the statements of some patients regarding the theory that their glasses made their eyes worse are in error.

Near Point of Accommodation Test. There are many ways to determine the amplitude of accommodation. One of these tests may be used by the optometry technician when completing an SF 88. The test is called Near Point of Accommodation, and is administered with the aid of a Prince rule and accommodation card. (See fig. 2-12.) Place the 0 point on the rule 15 mm from the cornea. Place the card near enough to the eyes that the patient cannot read it and slowly move it away until the patient can correctly read print having a vertical height of 1 mm (0.62 M or J2). Read the distance from the eye from the Prince rule in diopters of accommodation and record it as such. If a Prince rule is not available, dioptic values can be computed by dividing the near point in inches into 40 or the near point in centimeters into 100. You may recall from our 3ABR91235 course the roman size 8 {D = {1 over F}}. Patients being given Class I or IA examinations will be allowed to wear corrective lenses while the near point of accommodation is being determined.

Exercises (250):

1. Match each term in column B with its correct definition or description in column A.

Column A

_____(1) Function whereby the eye focuses for vision at various distances.
_____(2) Inability of eye to focus to various distances due usually to age.
_____(3) Ring-shaped muscle that surround the lens of the eye and acts to change its shape from ellipsoidal to spherical and vice versa.
_____(4) Maximum amount of accommodation that the eye can produce.
_____(5) Fibers that originate in the ciliary body and insert into the capsule of the lens; they act with the ciliary muscle or sphincter to determine the degree of convexity of the lens.
_____(6) Test of amplitude of accommodation.

Column B

a. Accommodation.
b. Amplitude of accommodation.
c. Near point of accommodation.
d. Zonules of Zinn.
e. Ciliary sphincter.
f. Presbyopia.

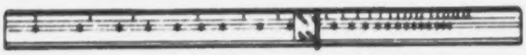


Figure 2-12. The Prince rule.

2. How is the Near Point of Accommodation test given?

3. In givng the test, where should you place the card?

4. What does the score represent?

251. Describe the basic concept of the Schirmer Tear test.

The Schirmer Tear Test. Probably, sometime in your career in the eye clinic you'll be tasked to give the Schirmer tear test. This test is designed to measure the amount of tears produced by the lacrimal glands. You may recall from reading other material that only 0.5 to 1 ml of our tears are produced during the day and none are produced at night. About 50 percent of the tears are lost through evaporation. The rest of the tears are carried to the superior and inferior puncta to be drained off.

What would prompt the doctor to order this test? The patient may be complaining of dryness, burning, or maybe a sandy or gritty sensation. The doctor may even ask it to be done prior to determining whether or not a patient could wear contact lenses comfortably.

Test materials consist of two pieces of filter paper, each 5 mm wide and 35 mm long in a sterile package. One end of the filter paper is rounded with a notch in one side about 5 mm from that end.

The accepted procedure for administering this test is very simple. The first thing is to find a nice comfortable chair, preferrably one with a headrest. After the patient is seated, explain what you are about to do. This will help, in most cases, relieve the patient's apprehension. Now that your patient is ready, prepare the filter papers. Leaving the filter papers in the package, bend the rounded end at the notch (about 90°) to make a wick. You can open the package at the opposite end and remove the filter papers. Next make sure you made a good impression on the patient. Instruct the patient to look up so that you can gently pull down his or her right lower lid. Place the bent end of the filter paper over the eyelid border just nasal to the center. You must be careful *not* to touch the cornea when putting the filter paper on the lid. That would cause reflex tearing and possibly pain, and cause the test to be invalid. You may do both eyes at the same time. Once you get the papers placed properly, take note of the time. The filter papers are to remain in place for 5 minutes. What can the patient do while 5 minutes is slowly passing by? The patient's may blink as is normal or even close his or her eyes, but must not squeeze them. That would cause corneal irritation and ruin the test again.

After the time has elapsed, remove the papers from each eye. To measure, use the mm scale on the package or a PD rule. You'll measure the moistened area from the notch down. Sometimes it's helpful to hold the paper up to the light to see the moistened area. It will be recorded as such: Schirmer Tear test OD. 18 mm OS. 17 mm, on the eye form you're using.

What does this reading represent? Read on and you'll find out.

The standard for most patients under the age of 40 is at least and usually over 15 mm in each eye. As you might guess, the older you get the less tears are produced. When you reach 40 years, a measurement of 10–15 mm in each eye is considered normal. Anytime you come up with less than 10 mm in each eye it should be given careful consideration. This is probably an indication of insufficient tear production called alacrima.

There is a variation of the Schirmer tear test called Schirmer's tear test Number 2. This is exactly the same as the test previously described except that a drop of anesthetic solution is put in the eye before the test. This supposedly eliminates any reflex tearing caused by the paper itself.

When a diagnosis of insufficient tearing is established, the treatment usually consists of placing a drop of artificial tears (methylcellulose) in the eye. There are many brands of artificial tears on the market, most of which are over the counter medications. Of course, a candidate for contact lenses who has insufficient tear production may be advised not to wear contact lenses.

Exercises (251):

1. What does the Schirmer Tear test measure?

2. What is the term alacrima used to identify?

3. During the Schirmer Tear test, how long should the wick be left in the eye?

4. In the test, how much moisture is considered to be the standard amount of wetting? How much moisture can patients over 40 normally be expected to have? What measurement usually indicates poor tear production?

252. Specify the concepts concerning blood pressure.

Blood Pressure. Blood pressure (BP) is the force exerted by the blood against the walls of the arteries as it flows through them. Primarily, the volume of blood in the arteries maintains your blood pressure. As long as the amount of blood leaving the arteries is equaled by the amount being pumped by the heart, the blood pressure is stable. Should some of the small elastic vessels relax and accept more blood or become too rigid and accept less blood, the blood pressure could be altered drastically.

Systolic pressure represents the *highest* point at which you hear the sound of the heart beat. This occurs when the heart's ventricles contract. *Diastolic* pressure is the *lowest* point at which you hear the sound of the heartbeat. This occurs during ventricular rest. (Some people prefer to use the point at which the beat softens or is muffled as diastolic—this is not wrong; only more difficult). The average normal adult blood pressure is 120/80, but there is a range of normal values depending on individual variations:

Systolic Range: 100–140
Diastolic Range: 60–90

Many factors affect blood pressure in the person who is well. It is normally lower in children, slightly higher for men than women of comparable age, higher in obesity, and higher under emotional distress, excitement or muscular exertion. Disease conditions that affect the circulatory and renal systems may increase the blood pressure; diseases that weaken the heart may lower pressure; pain will elevate pressure; certain drugs may cause an increase or decrease; hemorrhage and shock also lower the blood pressure. Terms used to describe blood pressure include hypertension, which means elevated BP, and hypotension, which means lowered BP.

The equipment you'll need to measure blood pressure consists of a stethoscope (NSN 6515–00–374–3330), a sphygmomanometer (NSN 6515–00–371–3100), and alcohol sponges.

The procedures for taking the blood pressure of a patient are:

a. Check the equipment for proper functioning.

b. Clean the earpieces of the stethoscope with alcohol sponges.

c. Explain the procedures briefly to reduce any anxiety that may have built up.

d. Have the patient roll up the sleeve or take the shirt off if the sleeve is too tight.

e. Position patient.

(1) Lying or sitting.

(2) Place arm in an abducted, slightly flexed position, palm upward.

(3) Support on a firm surface.

(4) Area should be at approximately same level as the patient's heart.

(5) Eliminate constriction about the arm.

f. Apply the cuff.

(1) Cuff should be 1 1/2 times as wide as the arm.

(2) Place approximately 1 inch above the antecubital space.

(3) Center the inflatable bladder (cuff) over the brachial artery even and snug.

g. Take the reading.

(1) Close the pressure system by turning the thumb screw clockwise.

(2) Locate the brachial pulse at the bend of the elbow with your finger.

(3) Place the stethoscope disc over the spot where the brachial pulse was felt.

(4) While listening with the stethoscope, rapidly pump the cuff to approximately 30 mm of pressure above the cessation of the arterial sound.

(5) While watching the sphygmomanometer dial, slowly deflate the cuff and listen very carefully.

(6) Take note of the first audible sound because it will be your first number to write down, being the systolic pressure.

(7) Now take note of when the sound disappears, because this will be the second number you write down, being the diastolic pressure.

h. Release the rest of the pressure and remove the cuff, and ask the patient to replace the shirt or roll down the sleeve.

i. Record BP as a fraction with the systolic as the numerator and the diastolic as the denominator; example: BP 124/78.

j. Clean the earpeices for the next person.

Many beginners have problems in taking BP's for one reason or another. They sometimes press the stethoscope too hard against the artery, or don't locate the artery in the first place, or let air out too fast, and so on.

Whatever reason you come up with, don't hesitate to ask for help. Taking blood pressure is very important to your doctor and most especially to the patient.

Exercises (252):

1. What is the average normal range for the blood pressure?

2. What type of pressure is the level of pressure in the arteries when the ventricles of the heart are contracted? When the ventricles of the heart are relaxed?

3. Will blood pressure increase or decrease with exertion or emotional stress?

4. When taking blood pressure, where should you place the disc of the stethoscope?

5. When releasing the air in the cuff, what is the first distinct audible sound?

6. How is a diastolic reading of 84 and a systolic reading of 118 recorded?

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Glossary

Abducens—The sixth cranial nerve that innervates the lateral recti.

Abduction—The movement of the eye temporally (out turning).

Aberrations—The deviation of light rays emanating from a point source that prevents the rays from forming a point focus after passing through an optical system.

Accomodation—The dioptric adjustment of the lens to attain maximum sharpness of retinal imagery. Usually it means adding plus power to the eye to see at near.

Adduction—The moving of the eye nasalward, or in turning.

Aditus Orbita—The front opening of the orbit.

Adnexa—The appendages of the eye—the lacrimal apparatus, eyelids, and extraocular muscles.

Amblyopia—Reduced visual acuity not correctable by refractive means to 20/20 and not due to pathological anomalies.

Amplitude—The height from the crest to the mean of a light wave.

Anseikonia—A relative difference in size or shape of the ocular images.

Anisometropia—A condition of unequal refractive states for the two eyes, usually of gross proportions.

Annulus of Zinn—Tendon that surrounds the optic foramen and is the point of origin for the rectus muscles.

Anterior Chamber—The chamber of the eye bound anteriorly by the cornea and posteriorly by the iris.

Aqueous Humor—The fluid that fills the anterior chamber and the posterior chamber.

Astigmia—A condition of refraction in which rays emanating from a single luminous point are not focused at a single point by an optical system.

Avascular—Containing no blood vessels.

Bifocal—A lens having two sections with different focal points.

Binocular—Pertaining to both eyes.

Bipolar Cells—Nerve cells in the retina related to the terminations of the rods and cones.

Blepharitis—Inflammation of the lid margins.

Blepharoconjunctivitis—Inflammation of the eye lids and conjunctiva.

Bony Orbit—The cavity in the skull that contains and protects the eyeball.

Bowman's Capsule—Thin membrane located between the corneal epithelium and the stroma.

Bulbar Conjunctiva—Conjunctiva covering the anterior surface of the eyeball.

Canal of Schlemm—The canal for removal of aqueous humor.

Canaliculi—The narrow tubular passages that connect the puncta to the lacrimal sac.

Caruncle—Small fleshy mound located at the medial canthus.

Cataract—An opacity of the crystalline lens.

Chalazion—Inflammatory enlargement of a meibomian gland.

Chorid—Vascular portion of the eye between the sclera and retina that provides nutrition for the eye.

Choriocapillaris—The portion of the choroid that nourishes the outer five layers of the retina.

Ciliary Body—Portion of the vascular tunic between the iris and choroid. It consists of the ciliary muscle and ciliary processes.

Ciliary Muscle—The smooth muscle of the ciliary body responsible for accommodation.

Ciliary Processes—Point of attachment for the Zonules of Zinn. Also the area where aqueous humor is manufactured.

Concave—A surface that curves inwards.

Cones—Specialized visual cells in the retina responsible for color vision and sharpness of vision.

Conjunctiva—A mucous membrane extending from the eyelid margin to the corneal limbus, forming the posterior layer of the eyelids and the anterior layer of the eyeball.

Consensual Reflex—The contraction of the opposite pupil to the eye that is being stimulated.

Convergent—Two or more light waves proceeding towards a point.

Convex—A surface that curves outwards.

Cornea—The transparent anterior portion of the fibrous tunic of the eyeball.

Corneal Endothelium—Innermost layer of the cornea.

Corneal Epithelium—Outermost layer of the cornea.

Crystalline Lens—A transparent, colorless body suspended between the aqueous and vitreous, the function of which is to bring the rays of light to a focus on the retina.

Cycloplegic—A drug that paralyzes the ciliary muscle preventing accommodation and also dilating the pupil.

Cylinder—Converges or diverges light to focus along one axis.

Descemet's Membrane—Layer of the cornea located between the stroma and the corneal endothelium.

Diffraction—Light striking a slit or small hole is deviated from a straight line because the light striking that slit becomes a new source of light.

Diffusion—The scattering of light.

Dioptrics—That branch of optics which deals with the refraction of light by transparent media.

Diplopia—Double vision.

Direct Reflex—The contraction of the pupil of the eye that is stimulated.

Dispersion—The breaking up of white light into its component colors.

Distortion—The defect in a lens that causes a straight line to appear curved.

Duplicity Theory—That vision is broken up into two types: photopic (cone or light vision) and scotopic (rod or darkness vision).

Effective Power—The effect of a lens upon the eye when it is moved from one distance before the eye to another.

Emmetropia—The visual condition identified by the conjugate focus on the retina from infinity when accommodation is relaxed.

Equivalent Power—The power prescribed for a new lens that has a different distance from the cornea than the old lens. Both lenses have the same effect on the eyes.

Esophoria—The latent turning inward of the covered eye when one eye is covered and fusion is not possible.

Esotropia—The manifest turning inward of one eye whether or not one is covered.

Ethmoid Bone—One of the bones forming the medial wall of the bony orbit.

Exophoria—The latent turning outward of the covered eye when one eye is covered and fusion is not possible.

Exotropia—The manifest turning outward of one eye whether or not one eye is covered.

Extorsion—The twisting of the eye from the nasal axis to the superior. Clockwise, left eye—counterclockwise, right eye—when looking at the eyes.

Extraocular—Pertaining to anything outside the eyeball.

Facial Nerve—The seventh cranial nerve that innervates the eyelids.

Fibrous Tunic—The outermost tunic of the eye, made up of the sclera and the cornea.

Fissure—A crack in the bony orbit.

Foramen—A hole in the bony orbit.

Fornix Conjunctiva—A loose fold of tissue located between palpebral conjunctiva and bulbar conjunctiva.

Fovea Centralis—An area in the macula lutea approximately 1.5 mm in diameter where visual acuity is highest because of the high percentage of cones and the fact that each cone is attached to only one cell.

Frequency—The number of waves passing a fixed point in 1 second.

Frontal Bone—The bone that forms the anterior portion of the roof of the orbit.

Fusion—The act or process of blending or uniting two images.

Ganglion Cells—Third order nerve cells of the retina. Bipolar cells synapse with ganglion cells, and axons of ganglion cells form the optic nerve.

Glands of Krause—Accessory lacrimal glands located in the fornix conjunctiva.

Glands of Wolfring—Accessory lacrimal glands located near the superior border of the tarsal plate in the upper eyelid.

Glands of Zeis—Sebum-forming glands located at the follicle of each eyelash.

Glaucoma—A sustained increase in intraocular pressure that causes damage to the eye.

Heterophoria—The latent tendency of the lines of sight to deviate from the relative positions necessary to maintain single binocular vision for a given distance of fixation.

Heterotropia (Strabismus)—The condition in which binocular vision is not present under normal seeing conditions.

Hordeolum (Sty)—Inflammation of a gland of Zeis.

Inferior—Located below or directed downward in relation to the eye.

Inferior Oblique Muscle—Extraocular muscle that originates on the anterior medial floor of the orbit and inserts on the posterior temporal sclera.

Inferior Orbital Fissure—An elongated crack in the orbit that begins below and lateral to the optic foramen and runs anteriorly and temporally in the floor of the orbit.

Inferior Rectus Muscle—Extrinsic ocular muscle that originates at the annulus of Zinn and inserts on the inferior sclera about 5 mm from the limbus.

Infinity—In optical science, a term used to denote a distance so great that the rays of light from it appear parallel.

Infraorbital Canal—A bony canal that originates from the infraorbital groove and terminates at the orbital margin.

Infraorbital Groove—A groove in the floor of the orbit that originates at the inferior orbital fissure and terminates at the infraorbital fissure.

Infrared—The light waves beyond the red portion of the visible spectrum; they are longer wavelengths than visible light.

Innervation—A nerve stimulus that moves a muscle.

Insertion—In optometry, the place where an extraocular muscle attaches to the eyeball.

Intorsion—The twisting of the eye from the nasal axis to the inferior. Clockwise, right eye—counterclockwise, left eye\(emwhen *looking* at the eyes.

Iris—The most anterior portion of the uveal tract, consisting of a circular pigmented membrane—perforated to form the pupil.

Iritis—Inflammation of the iris.

Lacrimal Bone—One of the bones that form the medial wall of the orbit.

Lacrimal Ducts—Ducts that receive secretions from the lacrimal gland and empty into the superior temporal fornix conjunctiva.

Lacrimal Fluid—The fluid secreted by the lacrimal glands.

Lacrimal Fossa—A vertical groove in the anterior medial wall of the orbit. It contains the lacrimal sac.

Lacrimal Gland—The gland, located in the anterior and superior and temporal area of the orbit, that secretes lacrimal fluid.

Lacrimal Sac—The saclike structure, located in the lacrimal fossa, that receives tears from the canaliculi and deposits them in the nasolacrimal duct.

Lamina Cribrosa—Thin sievelike portion of the sclera through which the optic nerve and central retinal vessels pass.

Lateral—Toward or pertaining to the temporal side of the eye.

Lateral Canthus—The area where the upper and lower eyelids meet on the temporal side of the eye.

Lateral Rectus—The extraocular muscle that originates at the annulus of Zinn and inserts on the lateral portion of the sclera about 5 mm from the limbus.

Levator Palpebrae Superioris Muscle—An extraocular muscle that originates from the small wing of the sphenoid and inserts at the skin and tarsal plate of the upper lid.

Light—The term commonly used for radiant energy which affects our eyes and gives us vision.

Limbus—The transitional zone between cornea and sclera.

Macula Lutea—An oval area in the retina 3 to 5 mm in diameter, located temporal to the posterior pole of the eye and slightly below the level of the optic disc. In its center is the fovea centralis. It provides for the best photopic visual acuity.

Magnification—An increase in the apparent or perceived size of an object.

Manifest—Shows up even in normal circumstances.

Maxillary Bone—The bone that helps form the anterior medial wall and floor of the orbit.

Medial—Toward or pertaining to the nasal side of the eye.

Medial Canthus—The area where the upper and lower eyelids meet on the nasal side of the eye.

Medial Rectus—The extraocular muscle that originates at the annulus of Zinn and inserts on the medial portion of the sclera about 5 mm from the limbus.

Meibomian Glands—A series of sebaceous glands located in the tarsal plate whose ducts empty into the lid margins.

Minus Lens—A lens that diverges light.

Monochromatic—Composed of light of one color.

Monocular—Pertaining to one eye.

Muller's Muscle—A small smooth muscle that originates at the levator palpebrae superioris and inserts on the upper margin of the tarsal plate.

Multifocal—A lens with two or more foci due to additional segments.

Myopia (Nearsightedness)—The refractive condition of the eye represented by the location of the conjugate focus of the retina at some finite point in front of the eye, when accommodation is said to be relaxed.

Nasal—Toward the nose.

Nasolacrimal Duct—The distal portion of the lacrimal apparatus through which tears drain into the nasal cavity.

Near Point of Convergence—The point of intersection of the lines of sight when the eyes are in the position of maximum convergence or crossing.

Ocular Media—The transparent substances of the eye through which light passes.

Oculomotor—The III cranial nerve—supplies all muscles of the eye except the lateral rectus and superior oblique.

Optic Disk—That portion of the optic nerve which is formed by the meeting of all the retinal nerve fibers. It is insensitive to light and corresponds to the physiological blind spot.

Optic Foramen—The hole located at the apex of the orbit through which the optic nerve passes.

Optic Nerve—The collection of over 800,000 fibers from the ganglion cells in the retina. It conducts nerve impulses to the optic tract.

Optic Radiations—Nerve fibers transmitting impulses from the lateral geniculate body to the visual cortex in the occipital lobe of the brain.

Optic Tracts—The bundles of nerve fibers transmitting impulses from the optic chiasm to the lateral geniculate body.

Optician—Dispenses glasses.

Ophthalmologist—Treats eye diseases and performs surgery. Has an MD and has taken a residency in ophthalmology.

Ophthalmology—The treatment of the pathological or unhealthy eye.

Optometrist—Has at least 6 years of college. Is concerned with vision and nonmedical visual care; diagnoses and refers eye diseases. Uses lenses and prisms to correct refractive visual defects.

Ora Serrata—A jagged line formed by the anterior edge of the retina.

Orbicularis Oculi Muscle—An oval sheet of muscle that surrounds the palpebral fissure.

Orthophoria—The condition of the eyes in which the lines of sight, in the absence of an adequate fusion stimulus, intersect at a point of reference, this point usually being the point of binocular fixation.

Palatine Bone—A small bone that helps form the posterior floor of the orbit.

Palpebral Conjunctiva—Conjunctiva covering the posterior surface of the eyelids.

Palpebral Fissure—The opening formed by the upper and lower eyelids.

Parallelism—That state where light rays are neither converging nor diverging.

Periorbita—The periosteum that covers the bones of the orbit.

Periosteum—Specialized connective tissue that covers all the bones in the body.

—PhotopicPertaining to the light levels of cone vision.

Plano—A surface with zero curvature.

Plica Semilunaris—A crescent-shaped fold of conjunctiva located at the medial canthus.

Plus Lens—A lens that converges light to a real focus.

Posterior Chamber—The chamber of the eye bound anteriorly by the iris and posteriorly by the anterior surface of the crystalline lens.

Primary Action—The major action of a muscle.

Prism—A wedge-shaped piece of glass or transparent material having plane or curved sides.

Prism Diopter—One prism diopter produces a deviation of 1 centimeter at a distance of 1 meter.

Ptosis—The falling down or drooping of the upper eyelid below its normal position.

Puncta—The small openings, located on the margin of each eyelid near the medial canthus, through which tears drain.

Pupil—The opening in the center of the iris.

Pupillary Distance (PD)—The distance between the centers of the pupils when in distance and reading positions.

Reciprocal—The reciprocal of a number is 1 divided by that number.

Refraction—The change in direction of light as it passes obliquely from one medium to another of a different density.

Retina—The light-receptive, innermost nervous tunic of the eye that represents the terminal expansion of the optic nerve.

Riolan's Muscle—That portion of the orbicularis oculi muscle which lies between the tarsal glands and the eyelash follicles.

Rods—Specialized cells in the retina responsible for discrimination of motion and night vision.

Sclera—The white, opaque, fibrous, outer tunic of the eyeball.

Scotopic—Pertaining to the light levels of rod vision.

Single Vision—A lens with one focus.

Sphenoid Bone—The bone that helps form the posterior part of the medial wall, lateral wall, and roof of the orbit.

Sphere—A lens with one point focus.

Spherical Equivalent—A spherical lens whose focal point coincides with the circle of least confusion of a given spherocylindrical lens. Is mathematically arrived at by adding algebraically one-half of the cylinder to the sphere.

Spherocylinder—A lens integrating a sphere and a cylinder.

—BStereopsisBinocular visual perception of three-dimensional space based on retinal disparity.

Stroma (Substantia Propria)—The thickest layer of the cornea, located between Bowman's membrane and Descemet's membrane.

Superior—Located above or directed upward in relation to the eye.

Superior Oblique Muscle—The extraocular muscle that originates above and nasal to the optic foramen, passes through the trochlear pulley, and inserts on the superior, temporal, posterior portion of the sclera.

Superior Orbital Fissure—An opening in the orbit connected to the optic foramen and lying between the wings of the sphenoid bone.

Superior Rectus Muscle—The extraocular muscle that originates at the annulus of Zinn and inserts on the superior portion of the sclera about 5 mm from the limbus.

Synergists—Muscles in one eye that together perform a given ocular movement.

Tarsal Plate (Tarsus)—A thin plate of fibrous tissue located in the upper and lower eyelids.

Temporal—Towards the temple.

The Fossa of the Lacrimal Gland—An indentation in the frontal bone located in the roof of the orbit, posterior and temporal to the orbital margin. Contains a portion of the lacrimal gland.

Toric—A compound or spherocylindrical lens.

Trabecular Meshwork—A fine net of fibrillar tissue located at the angle of the anterior chamber of the eye.

Transparent—Pertaining to a medium having the property of transmitting light so that objects can be seen through it.

Transposition—The mathematical switching of one cylinder form to another, either plus to minus or minus to plus.

Trifocal—A lens with three segments giving three ranges of vision.

Trochlear Fossa—An indentation located in the superior, anterior, nasal portion of the frontal bone. Contains the trochlear pulley.

Trochlear Nerve—IV cranial nerve; innervates the superior oblique.

Trochlear Pulley—A ringlike structure of fibrocartilage attached to the nasal portion of the frontal bone. The superior oblique passes through the pulley, which changes the direction of pull of the SO.

Vascular Tunic—The middle coat of the eyeball that contains the choroid, ciliary body, and iris, and provides the blood supply for the eye.

Vergence—A disjunctive movement of the eyes, as in convergence or divergence.

Version—Both eyes moving together in the same direction.

Visual Acuity—Acuteness, distinctness, clearness, or sharpness of vision.

Visual Cortex—That part of the brain that interprets the nerve impulses of the visual pathway.

Visual Field—The area or extent of physical space visible to an eye in a given position.

Vitreous Humor—The gelatinous, colorless, transparent substance filling the vitreous chamber of the eye.

Wavelength—The distance between the crest of one wave and the crest of the next wave.

Yoked Muscles—Muscles performing the same action in different eyes.

Zonules of Zinn—Suspensory fibers that connect the crystalline lens to the ciliary body.

Zygomatic Bone—The bone that helps form the lateral wall and floor of the orbit.

APPENDIXES

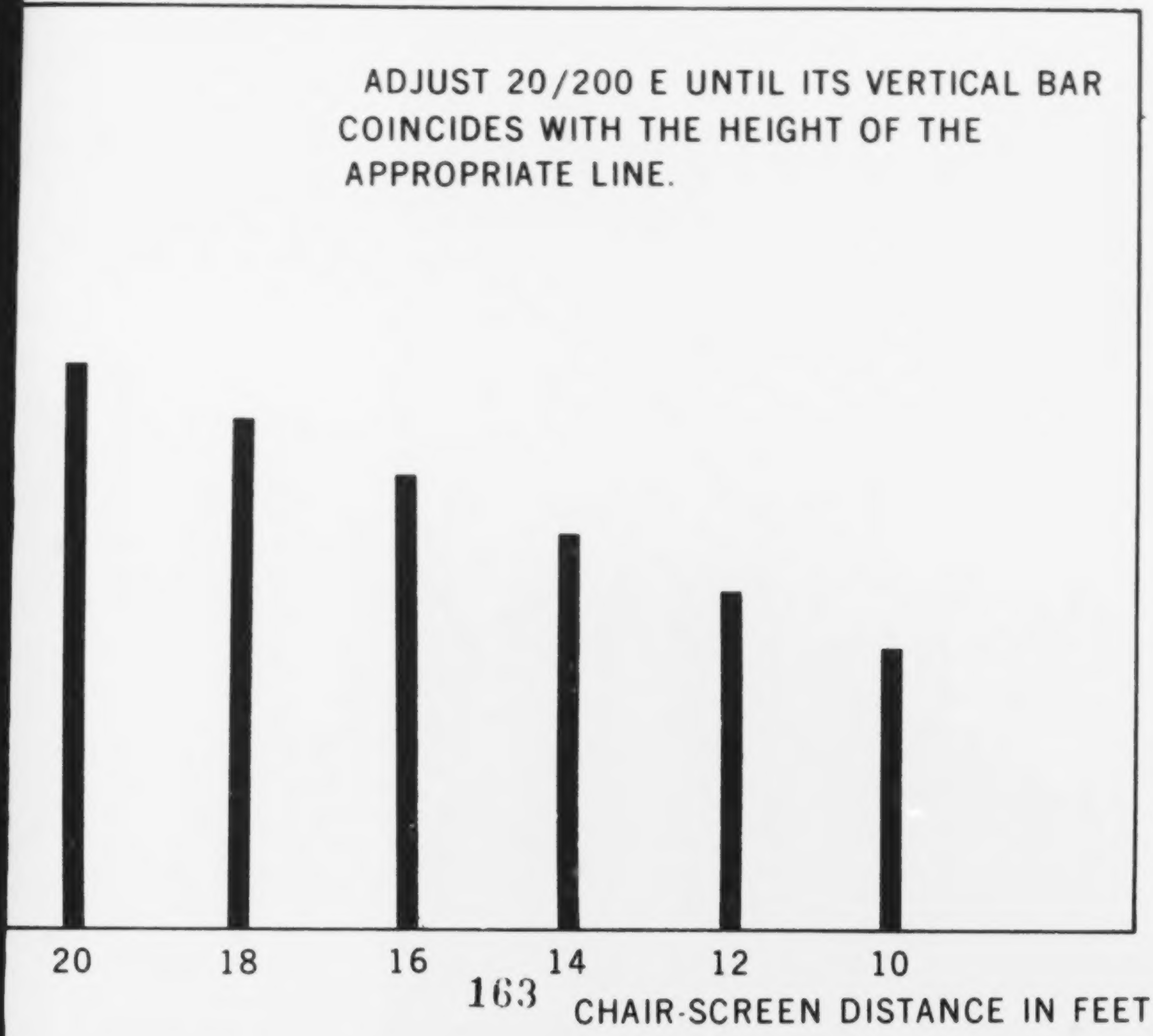
Appendix A. Calibration Scale for Projectochart

Appendix B. VTA-ND Scoring Keys

Appendix C. Visual Skills Record Form (Cumulative Form 3A) and Optional Test Cards Available for the Keystone Stereoscope

APPENDIX A

CALIBRATION SCALE FOR PROJECTOCHART



ADJUST 20/200 E UNTIL ITS VERTICAL BAR COINCIDES WITH THE HEIGHT OF THE APPROPRIATE LINE.

APPENDIX B

VTA-ND SCORING KEYS

SCORING KEY, VISION TEST APPARATUS, NEAR AND DISTANT VISION TESTING

FAR TESTS					
Score		Test 3—Small letters		Test 3A—Small letters	
		Left eye	Right eye	Left eye	Right eye
20/50	5	CDZNO KSRVH	VHDNS OZKRC	CRNDO SVZHK	KDZNV SHROC
	5A	NCVHR OZKDS	HVRDN ZSKCO	OZKRC SNDHV	RZNCS ODKVH
20/40	6	CNRKH ZVSDO	DVZNC SRHKO	ZVCOH DRSNK	VKRNZ CODHS
	6A	KDVHO RZSNC	ZCVHN RDOSK	ODVZR HSKNC	ODVNR CZSHK
20/30	7	DVHCK OZNSR	KNZCO SRDHV	ZKHSO VCDRN	HSDRZ NCVOK
	7A	HNCDO ZKSRV	DZONV RCSKH	OCVDR HZSKN	RNZVH OKSCD
30/25	8	CDKRO SZVNH	KNDRS ZVCOH	HNVZS CKRDO	ZOVCX NRKDH
	8A	CDSVO ZHRNK	HKZSC NROVD	OSRNZ CDHKV	KNROH SDZCV
20/20	9	CVHSZ ORKDN	VZCHD KNRSO	RHCVN ODSZK	RHSDK ONCVZ
	9A	VHOKC SRNZD	CKROH SDZNV	ZHODC SVNKR	OSCHN RVKZD
20/17	10	DNVHS OKRCZ	KZSVN HCRDO	KRNHC OSDVZ	KNRZD OHVCS
	10A	ZDVOH CRSKN	ZHRSN OKVDC	NDZOC HVKSR	RKCVN OZDSH
20/15	11	ZHODC SVNKR	RCSNV KDHOZ	SCHZD VKNRO	KZODR HNSCV
	11A	VDKHO RSZNC	VDHON RCKZS	VDNSK ZHCOR	ZDCKN SVRHO
20/12	12	KHOZD CSNVR	ROKHZ NSCVD	CNDZK OHRVS	RVNSZ KCDOH
	12A	ZVSDO CHNRK	CRNDO SZVKH	HOCVZ SRNKD	CSNDO HRVKZ
		Test 4—Large letters		Test 4A – Large letters	
		Left eye	Right eye	Left eye	Right eye
20/400	1	VNC	SDK	DKS	CNV
20/200	2	OZNKS	RCSZO	ORSCZ	RDHZC
	2	DRHCV	KNHDV	VDHNK	NSKVO
20/100	3	RZOHC KSNDV	HNZOS KRCVD	CVDRN OHZKS	ZVRNO HCSDK
20/70	4	RKNCZ HSDVO	ZHODC SVNKR	HKNZS RDCVO	DRSHC ZVNKO

Test 5—Depth						Test 5A—Depth						Score		Test 4—S	Illiterate
														Left eye	Right eye
A	B	C	D	E	F	A	B	C	D	E	F	20/400	1	URD	DUL
3	4	2	4	2	3	3	3	4	3	2	3	20/200	2	UDLUR	RULUD
2	3	4	2	4	3	2	4	2	2	3	2	20/100	3	ULDLU RURDL	LRRDR ULDRU
4	4	2	3	3	2	4	2	4	3		2	20/70	4	RUDRU DLDRL	LDLRU DURLU
												20/40	6	UDRLD LRDLU	DLRDR UDRLU
												20/30	7	RULDL URUDL	RUDRU DLURL
												20/20	9	LUDLR DUDRL	URLUD ULDRL

SCORING KEY, VISION TEST APPARATUS, NEAR AND DISTANT VISION TESTING

Score		NEAR TESTS		BINOCULAR ACUITY	
		Test 8—Small letters		Small letters	
		Left eye	Right eye	Test NS—3 near	Test NS—1 far
20/50	5	ZKCRV OHSDN	CVRZS DKHNO	OCVKR ZNSDH	OSDNH VKZCR
	5A	ORSNK VHDZC	OZRCV SKNDH	SDOVH CNZKR	SCVDK NZRHO
20/40	6	SDKVO ZRHNC	VZKCO HRSDN	ZHOCV NDRKS	RHZCD OSVKN
	6A	ZODVN HKSCR	NZCKO DSRHV	VNCSO KDZRH	OZNKR DVSCH
20/30	7	DHZRV SOKNC	HSZKN OVCDR	SDOVK HRNZC	SVNHO KCRDZ
	7A	NCKSR HZDVO	NRDVC ZKHOS	ZOHRC KDSNV	HNKZD VRCSO
20/25	8	DKOSN RVZCH	OVRHS CNDZK	DNHKO ZSRVC	RHSCK OZDVN
	8A	CKDSV OZNHR	VCHRD SKNZO	NSOZR VHKDC	CKDVO ZRNHS
20/20	9	KRZVD OSNCH	ZHCOR VDNSK	DSVKH ZNOCR	OZRVN HSCKD
	9A	VDOKH RZSCN	HVRSK ZODNC	NZOSR DVHCK	KDZRO VNHSC
20/17	10	OKSRN DHVCZ	RHCVN SDKZO	NZHKO RCVDS	DRHVN ZSKCO
	10A	HOVNC RZDSK	KRNHC DOSVZ	DNKOZ HSRVC	ZDSKC ORHNV
20/15	11	VRCHN OZKSD	CNZSR OHKDV	SNCZO RKVHD	OSKCV RZHDN
	11A	SVRNO CHZDK	DCVHK NOZSR	OCVNS DZKRH	CSHRV KNDZO
20/12	12	ROHKS VDNCZ	ODCNH VRSKZ	DHNVO SCZKR	SKHDN OCVRZ
	12A	KHRCV OSDNZ	RKCDO HVNZS	CNHRD OKSZV	KRSZC HNVDO

		Test 9—Large letters		Large letters	
		Left eye	Right eye	Test NS—4, near	Test NS—4, far
20/400	1	DSK	NVC	NVC	KDS
20/200	2	CRSZO	HNRCD	CZHSN	ZSKCO
	2	NDVHK	VOSZK	DKORV	VRHDN
20/100	3	OKZHS NCVRD	NDOCV RSZKH	KSDVO NHZCR	ZNSKH VDRCO
20/70	4	RCOVN DHKSZ	VRCNA OSDHK	VZOCS HRNKD	OZCRH NSKDV

INTERPRETATION OF PHORIA SCORES—FAR AND NEAR
Tests 1 and 6

Score	1	2	3	4	5	6	7	8	9
Prism Diopters	2.0	1.5	1.0	0.5	0	0.5	1.0	1.5	2.0
	Left hyperphoria					Right hyperphoria			

Test 2 An instrument score of 11 indicates orthophoria. If instrument score is greater than 11, that amount greater indicates prism diopters of exophoria. If instrument score is less than 11, that amount less indicates prism diopters of esophoria.

Test 7 An instrument score of 13 indicates orthophoria. If instrument score is greater than 13, that amount greater indicates prism diopters of exophoria. If the instrument score is less than 13, that amount less indicates prism diopters of espohoria.

APPENDIX C

VISUAL SKILLS RECORD FORM (CUMULATIVE FORM 3A) AND OPTIONAL TEST CARDS AVAILABLE FOR THE KEYSTONE STEREOSCOPE

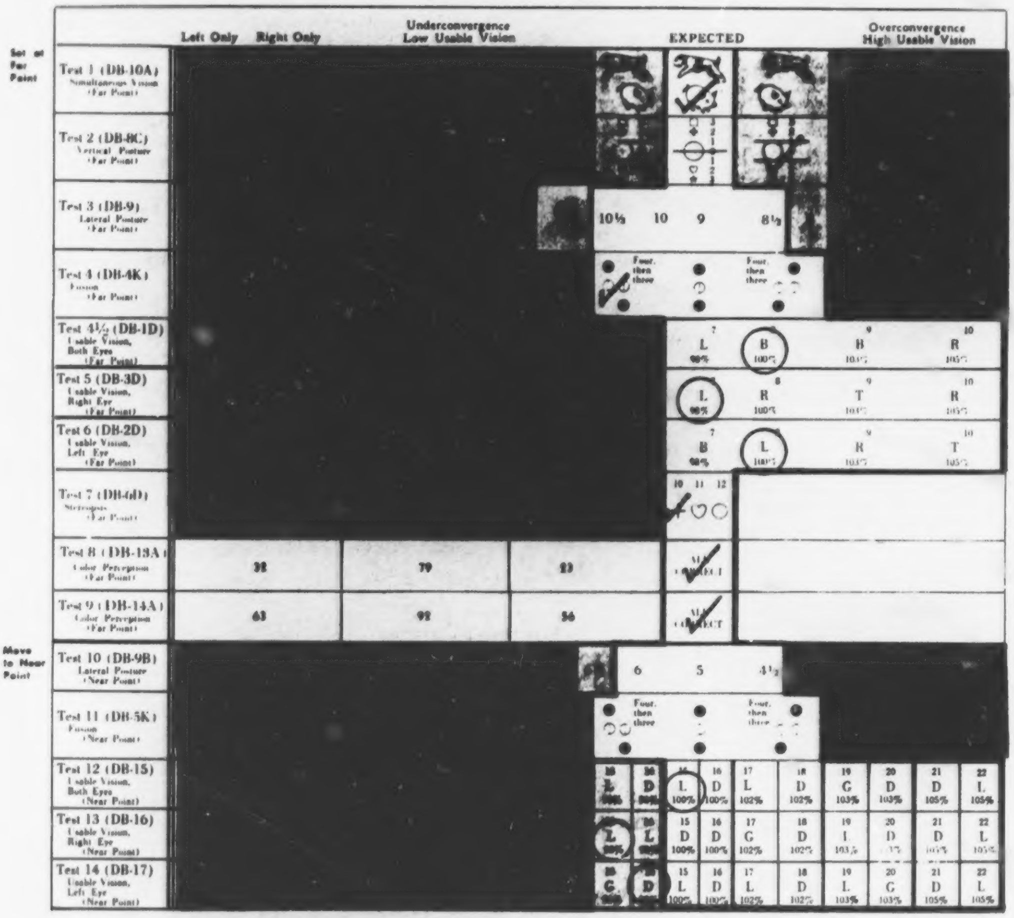
KEYSTONE VISUAL SKILLS PROFILE

Doctor's Cumulative
Profile Form No. 3A

For Use with Keystone Ophthalmic Telebinocular

Name JOHNNY, LITTLE Age 9½ Date 7 NOV 75 Wearing Glasses: Yes X No

PRESENT ℞ 1 YR. OLD. NO COMPLAINTS.
DOING "PRETTY WELL" IN SCHOOL



Left Only | Right Only | Underconvergence Low Usable Vision | EXPECTED | Overconvergence High Usable Vision

Set at Far Point

Test 1 (DB-10A) Simultaneous Vision (Far Point)

Test 2 (DB-8C) Vertical Posture (Far Point)

Test 3 (DB-9) Lateral Posture (Far Point) — 10½ 10 9 8½

Test 4 (DB-4K) Fusion (Far Point) — Four, then three — Four, then three

Test 4½ (DB-1D) Usable Vision, Both Eyes (Far Point) — 7 L 90% | 8 B 100% | 9 B 103% | 10 R 105%

Test 5 (DB-3D) Usable Vision, Right Eye (Far Point) — 7 L 90% | 8 R 100% | 9 T 103% | 10 R 105%

Test 6 (DB-2D) Usable Vision, Left Eye (Far Point) — 7 B 90% | 8 L 100% | 9 R 103% | 10 T 105%

Test 7 (DB-6D) Stereopsis (Far Point) — 10 11 12

Test 8 (DB-13A) Color Perception (Far Point) — 32 | 79 | 23 | ALL CORRECT

Test 9 (DB-14A) Color Perception (Far Point) — 63 | 92 | 56 | ALL CORRECT

Move to Near Point

Test 10 (DB-9B) Lateral Posture (Near Point) — 6 5 4½

Test 11 (DB-5K) Fusion (Near Point) — Four, then three — Four, then three

Test 12 (DB-15) Usable Vision, Both Eyes (Near Point) — L | D | 15 L 100% | 16 D 100% | 17 L 102% | 18 D 102% | 19 G 103% | 20 D 103% | 21 D 105% | 22 L 105%

Test 13 (DB-16) Usable Vision, Right Eye (Near Point) — L | L | 15 D 100% | 16 D 100% | 17 G 102% | 18 D 102% | 19 I 103% | 20 D | 21 D | 22 L 105%

Test 14 (DB-17) Usable Vision, Left Eye (Near Point) — G | D | 15 L 100% | 16 D 100% | 17 L 102% | 18 D 102% | 19 L 103% | 20 G 103% | 21 D 105% | 22 L 105%

BORDERLINE ACUITIES
MODERATE XO

RTC 6 MOS OR PRN

Sgt Travis
91255
424-61-7611

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APPENDIX C (Cont'd)

VISUAL SKILLS RECORD FORM (CUMULATIVE FORM 3A) AND OPTIONAL TEST CARDS AVAILABLE FOR THE KEYSTONE STEREOSCOPE

FAA Pilot Vision Test Set. Six targets - near and far VA, color blindness, lateral and vertical phorias. Results may be entered directly on FAA forms with no interpretation.

Occupational Vision (OVS) Test Set. Designed for industrial screening. Similar to Skills Series, but no animal antics. Comes with special manual. Needs OVS record forms.

OVS Rapid Screen Test. Two targets - far VA (letters) depth perception. Color vision, near VA (letters).

Industrial Short Tests. Three targets - vertical posture, fusion, usable vision at far and near (letters), color vision and stereopsis at far.

Driver Vision Test Set. Nine targets - all at farpoint. Similar Skill Series.

Universal Driver Test. One target - farpoint acuity at 20/40 and 20/30 (letters) stereopsis, red/green color vision, fusion.

Snellen nearpoint letters.

Snellen farpoint letters.

Intermediate Distance Acuity Test (for instrument-panel distance of 40").

Rapid Screening Test for Schools. Four targets - dog/pig, fusion, stereopsis, color, usable vision all (except dog/pig) for far and near.

Preschool Acuity Test (farpoint). One target of "familiar objects."

Ready to Read Test (nearpoint). Similar to above.

Illinois Visual Screen Set. Three targets - tumbling E, vertical imbalance at near, lateral imbalance at near and far, +1.75 plus lens test.

Massachusetts School Vision Test Set. Four targets and plus lens test.

Michigan School Vision Test Set. Four targets and plus lens test.

New York School Vision Test Set. Four targets and plus lens test.

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ANSWERS FOR EXERCISES

CHAPTER 1

Reference:

200 – 1. Compare your diagram to figure 1-2.

200 – 2. a. Lateral canthus—an anatomical landmark located where the upper and lower eyelids meet on the temporal side of the eye.
b. Medial canthus—an anatomical landmark located where the upper and lower eyelids meet on the nasal side of the eye.
c. Levator palpebrae superioris—the muscle primarily responsible for elevating the upper eyelid. This muscle originates at the apex of the orbit and inserts in the tarsal plate and skin of the upper eyelid.
d. Lacrimal fluid—the thin, watery fluid manufactured in the lacrimal gland. This fluid mixes with secretions from other glands and becomes tears.
e. Meibomian glands—sebaceous glands located in the tarsal plate. These glands secrete oils that lubricate the lid margins and mix with the tear layer.
f. Tarsal plate—the fibrous plate located in each eyelid that contains the meibomian glands, is the point of insertion for the levator palpebrae superioris and muscle of Muller, and forms the skeleton of each lid.
g. Orbicularis oculi—the oval sheet of muscle, located in the upper and lower eyelids, that surrounds the palpebral fissure and whose primary function is to close the eyelids.

201 – 1. Sleepy has ptosis—both of his upper eyelids droop.

201 – 2. The patient most likely has conjunctivitis. You should obtain her medical records, test her visual acuity, record her VA in the record, record her symptoms, and refer her to your optometrist. The visual acuity test will indicate any loss of vision, and the chief complaint will normally point out important symptoms of the patient's problem. These two factors will assist your optometrist in a diagnosis of the condition. You should always record your findings on the patient's medical record so that you may receive credit for the visit on your daily patient count. Also, medical record entries are required for legal reasons. You *must* write down a VA. Finally, all patients with the stated complaint should be referred to your optometrist or a physician. Remember that glaucoma and iritis, both serious diseases of the eye, may display the same symptoms as conjunctivitis.

202 – 1. Compare your answers with figure 1-4.
202 – 2. Compare your answers with figure 1-4.

203 – 1. Six.
203 – 2. Inferior oblique.
203 – 3. At the anterior medial floor of the orbit.
203 – 4. SR, IR, MR, LR, and SO.
203 – 5. 4 to 6.
203 – 6. Posterior and lateral.
203 – 7. The 3rd, 4th, and 6th.
203 – 8. SR, IR, MR, IO.
203 – 9. The SO.
203 – 10. Compare your answers with figure 1-5.

204 – 1. Compare your answers with figures 1-7, 1-8, and 1-9.

205 – 1. Date of treatment, the patient's name, and SSAN (or sponsor's SSAN).
205 – 2. Patient's age; sponsor's name, organization, rank, and duty phone.
205 – 3. Name, rank, SSAN, AFSC, and signature.
205 – 4. Questions about the patient's chief complaint and ocular history.
205 – 5. Neutralize the patient's glasses.

206 – 1. (1) h.
(2) m
(3) c, j.
(4) a.
(5) d.
(6) f, g.
(7) i.
(8) l.
(9) o.
(10) e.
(11) n.
(12) b.
(13) p.
(14) k.

207 – 1. (1) c, f.
(2) a, d.
(3) b, e.
(4) a, d.
(5) a, d.
(6) b, e.
(7) c, f.
(8) a, d.
(9) c, f.

207 – 2. Have them count the fingers on your hand and record their score.
207 – 3. Shine the projector light on various areas of the room and record the score as LL only.
207 – 4. Turn the lights on and off and record the score as LP only.
207 – 5. Amblyopia.
207 – 6. Suppression.
207 – 7. Amblyopia.

208 – 1. a. *Advantages*: Highest compatibility with visual analysis, no additional space needed, and good test procedure flexibility.
b. *Disadvantages*: Eye lane may be in use, and patients may confuse screening and visual analysis.

209 – 1. (1) Abnormalities of the ocular adnexa; (2) excessive refractive error and amblyopia.
209 – 2. (1) Retinoscopy; (2) ocular pathology.
209 – 3. Visual acuities.

210 – 1. By moving the objective lens tube (focusing tube).
210 – 2. By unlocking the set of screws in the base of the stand and adjusting the supporting column heights.
210 – 3. So that the projected letters are the proper size.
210 – 4. Measure the Snellen 20/200 letter in millimeters.
210 – 5. By previously marking its position on the floor.
210 – 6. Green; red.
210 – 7. By using the line selector devices and slide control knob.
210 – 8. By using the horizontal line selector in conjunction with vertical line selector.
210 – 9. By wiping them with a soft, clean, dry cloth.
210 – 10. Wipe bulb clean of fingerprints.

210 – 11. (1) a.
(2) c.
(3) a.
(4) b.
(5) d.
(6) b.
(7) c.
(8) d.

211 – 1. F. Small children and illiterates cannot use the letter charts.
211 – 2. T.
211 – 3. F. The use of (+) or (−) symbols is improper. Consider the line passed if 75 percent of responses were correct.
211 – 4. True, but the (+) or (−) symbols may be used also.
211 – 5. True, but only for purposes of completing an SF 88. Use (+) or (−) symbols for routine exam forms.

212 – 1. Flying trainees (Class I and IA).
212 – 2. All patients except Class I and IA physicals.
212 – 3. (1) Using the numerator 20/(Snellen).
(2) Using the numerator 14/.
(3) Using Jaeger optotype size—"J" plus the number of the smallest line of letters the patient can read—for example, J2.
(4) Using Snellen metric symbols.

213 - 1. T.
213 - 2. F. The pinhole will improve VA in refractive cases only.
213 - 3. T.
213 - 4. F. Light passing along the principal axis of an optical system is not refracted.
213 - 5. F. The acuities will be poorer with a pinhole.

214 - 1. Hyperopia of moderate to severe degree.
214 - 2. Place a +1.25D sphere lens in front of the eye being tested and ask the patient to read the smallest line that he or she can read.
214 - 3. The patient fails; the patient passes.
214 - 4. Give the patient an appointment for a complete visual analysis.

215 - 1. (1) e.
(2) k.
(3) c.
(4) j.
(5) d.
(6) l.
(7) g.
(8) i.
(9) m.
(10) h.
(11) f.
(12) a.
(13) b.
(14) n.

216 - 1. (1) d.
(2) a.
(3) e.
(4) j.
(5) b.
(6) h.
(7) c.
(8) i.
(9) g.
(10) f.

217 - 1. (1) b.
(2) d.
(3) a.
(4) c.
217 - 2. By placing a prism over the deviating eye.
213 - 7. CT ortho.

218 - 1. (1) d.
(2) f.
(3) n.
(4) b.
(5) h.
(6) i.
(7) g.
(8) e.
(9) a.
(10) c.
(11) j.
(12) k.
(13) l.
(14) m.

219 - 1. How near an object may be brought to the eyes before the patient's eyes stop converging.
219 - 2. The patient may suppress while his or her eyes diverge, or the patient may see double.
219 - 3. Diplopia.
219 - 4. All personnel being examined for flying qualification in Classes I and II.
219 - 5. They cannot wear glasses while taking this test.
219 - 6. Approximately 15 mm from the anterior corneal surface.

220 - 1. Direct, consensual, and accommodative.
220 - 2. Light (direct and consensual) and blur (accommodative).
220 - 3. To distinguish between normal and abnormal pupillary reflex responses.

221 - 1. Evenly.
221 - 2. The pupils should constrict in a balanced manner, remain round, and be equal at start and stop of the test.
221 - 3. PERRLA.
221 - 4. Record the abnormality and notify the doctor.

222 - 1. By raising or lowering the instruments.
222 - 2. Use the brake lock.
222 - 3. By using the crank on the far drum.
222 - 4. By a spring stop.
222 - 5. Less than.
222 - 6. Use the switch located on the power cord.
222 - 7. Presbyopes wearing bifocals.
222 - 8. A demonstration device.
222 - 9. An answer key and record sheets.
222 - 10. It should have sufficient area and height.
222 - 11. Inclined.
222 - 12. A 110-120-volt source.

223 - 1. F. The near slides are reached by lowering the viewing box.
223 - 2. T.
223 - 3. T.
223 - 4. F. Each drum light has its own bulb cap.
223 - 5. F. The bulb cap controls evenness of illumination.
223 - 6. T.
223 - 7. T.
223 - 8. F. The line of vision is slightly downward.
223 - 9. T.
223 - 10. F. Watch for squinting, tilting of the head, maintenance of proper viewing distance, etc.

224 - 1. (1) a.
(2) b.
(3) c.
(4) d.
(5) a.
(6) e.
224 - 2. An instrument score, not a numerical measure of the visual ability tested.
224 - 3. In Appendix C.
224 - 4. The variable prism.
224 - 5. In as far as they will go.
224 - 6. As much as four steps.
224 - 7. Over one eye or the other.
224 - 8. In case the patient has memorized one of the charts.
224 - 9. The lowest line of letters that the patient can read with three errors or less.
224 - 10. The near drum is used in test 6.
224 - 11. The near drum is used in test 7.
224 - 12. Far acuity.

225 - 1. Distant monocular acuities, distant phorias, near monocular acuities, and near phorias.
225 - 2. Dirty slides, dirty lenses, squinting, and improper viewing distance.

226 - 1. Quiet atmosphere and subdued lighting.
226 - 2. To the patient's right and facing him or her.
226 - 3. Table space should be sufficient to hold the instrument and paperwork. The height should be 26-30 inches, and the instrument should be placed near the table's edge.
226 - 4. Have them stand.
226 - 5. (1) Is it plugged in? (2) Are the lenses clean and the instrument dustless? (3) Are the targets in proper sequence and positioned? (4) Are the bulbs OK?
226 - 6. To avoid fatigue and maintain proper viewing distance.
226 - 7. 25-watt, frosted, showcase bulb (same as used in VTA-ND) in the target-illumination lamp, and a white, 6-watt, Christmas-tree bulb in the patient-eye inspection lamp.
226 - 8. Dust with soft cloth or tissue. Wash with mild soap and water when very dirty.

227 - 1. (1) d.
(2) c.
(3) b.
(4) a.

228 - 1. (1) a.
(2) b.

(3) d.
(4) e.
(5) c.

229 – 1. (1) a.
(2) c.
(3) b.

230 – 1. Single binocular vision (fusion).
230 – 2. High phoria and that fusion is maintained with effort.
230 – 3. Single binocular vision.
230 – 4. The eye fusion is difficult or doubtful.
230 – 5. Poor or absent fusion.
230 – 6. Gross suppression—look for amblyopia and squint.

231 – 1. The Snellen test measures monocular acuities monocularly; the usable vision test measures monocular acuities in a binocular field.
231 – 2. To determine whether there has been functional loss of vision.
231 – 3. It is a sign that central suppression exists.

232 – 1. +0.25
232 – 2. By the last correctly named symbol.
232 – 3. Do not let the patient study the cards too long.
232 – 4. Color vision.
232 – 5. 2.50.
232 – 6. Both test usable vision while fusion is maintained.

233 – 1. (1) Tests are designed for children and may seem inappropriate for adults. (2) Acuity tests must be converted to Snellen notation if comparisons are to be done. (3) Special record forms may easily get lost.
233 – 2. Snellen letters.

CHAPTER 2

234 – 1. (1) g.
(2) f.
(3) e.
(4) d.
(5) a.
(6) j.
(7) c.
(8) i.
(9) b.
(10) h.

235 – 1. Split-field photometer or split-field anomaloscope.
235 – 2. Adjust the spectometers so that the second half of the screen produces the same color as the first half of the screen.
235 – 3. Each cone in the eye is sensitive to one of the three primaries.
235 – 4. White; black; color (hue).
235 – 5. Warm colors are produced by the catabolism (breakdown) of a substance combined in a cone, while cool colors are produced by the anabolism (buildup) of a substance in a cone.
235 – 6. Zone theories.

236 – 1. (1) b.
(2) g.
(3) a.
(4) c.
(5) e.
(6) d.
(7) f.

237 – 1. 4.
237 – 2. 1.
237 – 3. 5.
237 – 4. 6.
237 – 5. 3.
237 – 6. 2.

238 – 1. F. Seat the patient 10 feet from the instrument.
238 – 2. T.
238 – 3. T.
238 – 4. T.
238 – 5. F. Count only the correct responses up to the first error.
238 – 6. F. Repeat the test only if the patient comes within 3 points of passing.
238 – 7. F. The test is given under normal room light.
238 – 8. T.

239 – 1. (1) c.
(2) d.
(3) a.
(4) e.
(5) b.
(6) f.
(7) g.
239 – 2. Central (photopic).
233 – 9. Peripheral (scotopic).
239 – 4. Fine-grained.
239 – 5. Coarse-grained.
239 – 6. Rods are colorblind, whereas cones can differentiate colors.
239 – 7. 20/200-20/400.

240 – 1. Steropsis.
240 – 2. VTA(enND, Keystone; Verhoeff.
240 – 3. Diplopia or double vision.
240 – 4. (1) d.
(2) b.
(3) h.
(4) g.
(5) a.
(6) e.

241 – 1. The Howard-Dolman uses an actual difference in depth, while the Keystone simulates depth by using sectional image displacement.
241 – 2. The VTA–ND.
241 – 3. When the patient fails the VTA–ND; and When the VTA–ND is unavailable.
241 – 4. Glasses may not be worn.

242 – 1. (1) a.
(2) d.
(3) b.
(4) c.

243 – 1. Omit the depth test and enter "X" on the exam.
243 – 2. Omit the depth test and enter "X" on the exam.
243 – 3. Hurry through the exam.
243 – 4. Group A.
243 – 5. When you are satisfied that the patient understands the test procedure.
243 – 6. By number.
243 – 7. The score is the letter of the last group in which the patient made no errors.

244 – 1. By shifting the position of three rods.
244 – 2. By showing the positions at close range.
244 – 3. Hold the device steady; do not expose target while changing sets; do not allow patient to move his or her head.
244 – 4. Eight.
244 – 5. Two.
244 – 6. 1 meter.

245 – 1. T.
245 – 2. F. Five readings are usually sufficient.
245 – 3. F. The patient may wear glasses.
245 – 4. T.
245 – 5. T.
245 – 6. F. The patient must not move his or her head. The patient must not be able to note any positional cues on the cords, and must not move the rods from end to end of box. You must screen the box from the patient's view when you readjust the rods.

246 – 1. T.
246 – 2. F. The patients may wear glasses.
246 – 3. F. The test, in fact, is more often given to children.
246 – 4. T.

247 – 1. (1) Suppression—turning off one eye.
(2) Fusion—putting the two images together.
247 – 2. a. Diplopia.
b. Aniseikonia.
c. Unequal refractive nerve.

248 – 1. (1) c.
(2) d.
(3) a.
(4) e.
(5) b.

249 – 1. (1) b.
(2) c.
(3) a.
(4) d.
249 – 2. a. F. The patient looks away from the straight ahead position.
b. T.
c. T.
d. F. A change of color indicates suppression.
250 – 1. (1) a.
(2) f.
(3) e.
(4) b.
(5) d.
(6) c.

250 – 2. With the aid of a Prince rule if one is available. If not, the distance can be measured in centimeters or inches and converted.
250 – 3. Near enough to the eye that the patient cannot read the letters.
250 – 4. The minimum distance at which the patient can read print having a vertical height of 1 mm.

251 – 1. Tear production.
251 – 2. Insufficient tear production.
251 – 3. 5 minutes.
251 – 4. 15 mm or more. A moistened area of 10 mm to 15 mm. A measurement of less than 10 mm.

252 – 1. Systolic 100(en140 and diastolic 60–90.
252 – 2. Systolic; diastolic.
252 – 3. Increase.
252 – 4. Over the brachial artery.
252 – 5. Systolic.
252 – 6. 118/84.

1984-746-037/2087 AUGAFS,AL(842247)300

STOP - 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

91255 02 23

PRELIMINARY CLINICAL PROCEDURES

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet .
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover your answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you have to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If mandatorily enrolled student, process questions or comments through your unit trainer or OJT supervisor. If voluntarily enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE. In parenthesis after each item number on the VRE is the Learning Objective Number where the answer to that item can be located. When answering the items on the VRE, refer to the Learning Objectives indicated by these Numbers. The VRE results will be sent to you on a postcard which will list the actual VRE items you missed. Go to the VRE booklet and locate the Learning Objective Numbers for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the best answer to each question.

1. (200) Which of the following muscles closes the eyelid during a blink?

   a. The levator and Riolan's muscle.
   b. The levator and the muscle of Muller.
   c. Orbicularis oculi and Riolan's muscle.
   d. Orbicularis oculi and the muscle of Muller.

2. (200) Name the glands that are located in the tarsal plate?

   a. Oil glands.
   b. Meibomian glands.
   c. Glands of Zeis.
   d. Glands of Wolfring.

3. (200) The point where the upper and lower eyelids meet near the nose is called the

   a. plica semilunaris.
   b. lateral canthus.
   c. caruncle.
   d. medial canthus.

4. (201) Name the most common eyelid disease?

   a. Iritis.
   b. Ptosis.
   c. Glaucoma.
   d. Blepharitis.

5. (201) What name would your doctor most likely give to a painless, hard lump in the upper eyelid?

   a. Ptosis.
   b. Chalazion.
   c. Hordeolum.
   d. Conjunctivitis.

6. (202) The strongest and weakest bones, respectively, in the orbit are the

   a. zygomatic and ethmoid.
   b. maxillary and sphenoid.
   c. sphenoid and zygomatic.
   d. palatine and maxillary.

7. (203) Which extraocular muscle is innervated by the sixth cranial nerve?

   a. Medial rectus.
   b. Lateral rectus.
   c. Superior rectus.
   d. Superior oblique.

8. (203) Which extraocular muscle is innervated by the fourth cranial nerve?

   a. Inferior oblique.
   b. Medial rectus.
   c. Superior oblique.
   d. Superior rectus.

9. (204) What portion of the choroid provides blood supply to the retina?

a. The central retinal artery.
b. The ciliary body.
c. The choriocapillaris.
d. The central retinal vein.

10. (204) Where on the retina is the highest concentration of the cones?

a. Optic disc.
b. Macula.
c. Ora serrata.
d. Fovea centralis.

11. (204) The crystalline lens is attached to the ciliary muscles by

a. Annules of Zinn.
b. Zonules of Zinn.
c. Annules of Zeis.
d. Zonules of Zeis.

12. (205) In addition to date of treatment, what is the minimal patient identification data to be entered on any form included in the patient's medical records?

a. Name, SSAN (or sponsor's SSAN).
b. Name, rank (or sponsor's rank), SSAN (or sponsor's SSAN).
c. Name, rank (or sponsor's rank), previous date of treatment, SSAN.
d. Name, rank (or sponsor's rank), previous date of treatment, SSAN, organization.

13. (205) The first step in preparing to examine a patient is the determination of the patient's

a. visual acuities.
b. chief complaint.
c. ocular history.
d. old spectacle prescription.

14. (206) Name the visual acuity factor that is most closely associated with refractive errors?

a. Ametropias.
b. Retinal sensitivity.
c. Stimulus perception.
d. Number of receptors stimulated.

15. (207) Assume your eye lane has a chair-screen distance of 15 feet. If you use a paper wall chart designed for 20 feet, which is the actual 20/20 line on the chart?

a. 20/10.
b. 20/15.
c. 20/25.
d. 20/30.

16. (207) If your patient cannot read the largest letter on the wall chart, you should

a. give the patient the nearpoint card.
b. turn the lights up brighter.
c. have the patient walk toward the chart.
d. have the patient put his/her glasses on.

17. (207) In strabismus, the amblyopic eye is usually

a. heterotropic.
b. patched.
c. hyperopic.
d. contralateral.

18. (208) Which of the following is a disadvantage of the eye lane test?

a. Test procedures are flexible.
b. It is highly compatible with visual analyses tests.
c. Patients believe they are receiving a visual analysis.
d. You do not need additional space for supplementary equipment.

19. (209) The first test in any eye examination, including a vision screening, should be

a. examination for pathology.
b. neutralization of old Rx.
c. determination of refractive error.
d. determination of visual acuities.

20. (210) Letter size is very important when using the projectochart. Correct size may be obtained by adjusting the projectochart with respect to the

a. projector and screen.
b. projector and chair.
c. screen and patient.
d. phoropter and projector.

21. (210) What two types of exams are normally given in an eye clinic?

a. Keyhole and distance.
b. Dry and wet.
c. Manifest and pinhole.
d. Cycloplegic and distance.

22. (211) What percentage of a line must a patient read correctly to receive credit for it?

a. 50 percent.
b. 65 percent.
c. 75 percent.
d. 80 percent.

23. (211) Which of the following farpoint visual acuities is administratively acceptable for use on an SF 88?

a. 10/20. c. 20/40.
b. 20/30-3. d. 20/50+3.

24. (212) Refer to text Table 1-1. Although the recording of farpoint visual acuities is fairly standardized, nearpoint acuities may be recorded in several different forms. Which of the following is usually not acceptable as a nearpoint acuity record?

a. 6/6. c. 20/20.
b. 14/14. d. J-1.

25. (213) The pinhole eye test works because it

a. eliminates the pupil.
b. reduces unwanted reflections.
c. concentrates light on fovea.
d. eliminates ocular dioptrics.

26. (214) The plus lens eye test is designed to detect moderate amounts of

a. emmetropia. c. myopia.
b. hyperopia. d. presbyopia.

27. (215) Two muscles which perform the same action in opposite eyes are called

a. yoked muscles. c. synergistic muscles.
b. antagonistic muscles. d. disjunctive muscles.

28. (215) Muscle action that causes the eye to turn inward is called

a. depression. c. extorsion.
b. intorsion. d. adduction.

29. (216) During an eye test, with both eyes open, a patient fixates on the large E on the wall chart. If the left eye appears to wander temporally the patient is

a. a left exotrope. c. a left esotrope.
b. an exophore. d. an esophore.

30. (217) While performing the cover-uncover test, you notice that the patient's left eye appears to wander temporally when covered but returns to fixate when the cover is removed. The patient is

a. a left exotrope. c. a left esotrope.
b. an exophore. d. an esophore.

31. (218) You are performing the Hirschberg eye test on a child. The reflex of the penlight in the right eye is centered while the reflex in the left eye is 2mm closer to the medial limbus. The patient is

a. 2 Δ LET.
b. 2 Δ LXT.
c. 16° LET.
d. 16° LXT.

32. (218) You are performing a Diagnostic H eye test on a patient. The right eye fails to fixate when you hold the penlight in the 2 o'clock position (as viewed by you). The patient probably has an underactive

a. RLR.
b. RSR.
c. RIO.
d. RSO.

33. (219) Which of the following is an administratively correct method of recording NPC in item 62, SF 88?

a. 2 1/4 inches.
b. 5.8 cm.
c. 72 mm.
d. 65.

34. (220) The accommodative pupillary reflex is initiated usually by

a. blurriness.
b. bright lights.
c. dim lights.
d. command.

35. (221) The room lighting needed to perform the pupillary reflex tests should be

a. very dark.
b. bright.
c. even.
d. light in corner.

36. (221) You have examined a patient with normal pupillary reflexes. You should record your finding as

a. "Passed."
b. "PERRLA."
c. "Normal."
d. "Present."

37. (222) The brake lock lever on the VTA-ND is located

a. above the viewing box.
b. below the occluder handle.
c. next to the powerline cord.
d. near the rear pivot.

38. (222) How many test positions are available on the farpoint drum of the VTA-ND?

a. 5.
b. 8.
c. 10.
d. 12.

39. (223) What condition may result if the VTA-ND bulb caps are improperly adjusted?

a. Bulbs may break.
b. One or both bulbs may not turn on.
c. Target illumination may be wrong.
d. Bulb heat may damage the slides.

40. (223) The only patients that you should allow to change head position when you adjust the viewing box on the VTA-ND are

a. myopes wearing oversize lenses.
b. hyperopes wearing high plus lenses.
c. emmetropes wearing no glasses.
d. presbyopes wearing bifocals.

41. (224) The scoring position for the vertical phoria test on the VTA-ND is obtained when both control handles are

a. in.
b. out.
c. right.
d. left.

42. (224) Which VTA-ND tests are located on the far drum?

a. 1-5.
b. 1-9.
c. 5-10.
d. 5-12.

43. (224) If a patient cannot see well enough to take a phoria test on the VTA-ND, the patient's score for that test is

a. 0.
b. X.
c.
d. N.D.

44. (224) Assume that you are determining visual acuities with the VTA-ND. In drum position 3, how many letters must a patient read correctly on any line in order to get full credit for that line?

a. 12 out of 15.
b. 10 out of 15.
c. 10 out of 10.
d. 7 out of 10.

45. (225) Which of the following VTA-ND tests is usually omitted when using the instrument in a vision screening program?

a. Distant monocular acuity.
b. Distant depth perception.
c. Near monocular acuity.
d. Near ocular phorias.

46. (226) The main (target illumination) bulb in your Keystone Telebinocular has just burned out. One of the places to get an emergency spare is from

a. a VTA-ND
b. a 40-watt desk lamp.
c. an A.O. projectochart.
d. a string of Christmas tree lights.

47. (227) You are screening a patient with the Keystone unit using the visual skills series of test cards. The patient reports seeing only the dog on test No. 1. What is your next step?

a. Occlude the right eye and test for suppression.
b. Perform all subsequent tests in the eye lane.
c. Discontinue testing since the patient is monocular.
d. Skip all subsequent tests except right eye acuities and color vision.

48. (228) Assume that Keystone unit test 2 in the visual skills series shows a yellow line and red figures. An abnormal response indicates the patient is

a. myopic.
b. exotropic.
c. hyperphoric.
d. color blind.

49. (229) The third test in the visual skills series of the Keystone unit shows an arrow and some dots. Expected values are in which range?

a. 1 to 7.
b. 8 to 11.
c. 12 to 15.
d. 15 to 17.

50. (229) Which of the following values on the Keystone farpoint lateral phoria test indicates exophoria?

a. 3.
b. 6.
c. 9.
d. 12.

51. (231) The Keystone tests what kind of visual acuity?

a. Usable.
b. Maintained.
c. Percentage.
d. Exact.

52. (232) The visual skills series of tests uses 14 test cards. The first series of cards are shown with the instrument set at infinity. You should move the cardholder to the 2.50 (nearpoint) position after

a. test 7 - stereopsis.
b. test 8 - color vision.
c. test 9 - color vision.
d. test 10 - lateral phoria.

53. (232) The Binocular Acuity at Nearpoint chart uses what types of symbols for testing?

a. Letters in balls.
b. Railroad tracks.
c. Telephone poles.
d. Dots, lines, and solid gray.

54. (233) One of the disadvantages of the skills series tests on the Keystone instrument is the

a. high miss rate by adult patients.
b. necessity to give the test in dim light.
c. necessity to convert to Snellen equivalents.
d. tendency for the technician to score subjectively.

55. (234) Color vision may change with eye

a. color.
b. pathology.
c. age.
d. refractive error.

56. (234) The sensation of brightness is most closely related to what physical attribute of light?

a. Amplitude.
b. Wavelength.
c. Velocity.
d. Radiation.

57. (235) The "zone theories" of color vision are based upon

a. Herings theory only.
b. Youngs theory only.
c. the Young-Helmholtz only.
d. the Young-Helmholtz and Hering theories.

58. (235) The Hering theory of color vision states that there are how many basic sensations?

a. Three.
b. Four.
c. Six.
d. Eight.

59. (236) If you examined a random population of 1000 men, about how many color defectives would you expect to find?

a. 50.
b. 80.
c. 120.
d. 175.

60. (236) If you examined a random population of 1000 women, about how many color defectives would you expect to find?

a. 1.
b. 5.
c. 50.
d. 100.

180

61. (237) In which light should the VTS-CV be given?

a. Fluorescent lamp.
b. Normal room light.
c. Light from the special easel lamp.
d. Sunlight from a northern exposure.

62. (238) In which light, if any, should the VTA-CTT be given?

a. None (dark).
b. Dim.
c. Normal.
d. Bright.

63. (238) A patient has just failed the VTS-CV by missing 8 of the 14 test cards. Three retests, using the VTA-CTT, were done, and the patient correctly named an average of 49 of the lights. This patient would be classified as having

a. normal color vision.
b. deficient red-green color perception, grade 1.
c. deficient red-green color perception, grade 2.
d. deficient red-green color perception, grade 3.

64. (238) In order to fail the FALANT test, the patient must miss how many lights on the last two runs?

a. One or more per run.
b. Average VTS-CV score minus FALANT score.
c. If average FALANT score plus VTS-CV score exceeds two.
d. Any VTA-CTT failure combined with VTS-CV failure.

65. (239) Scotopic vision is used with what light-anatomy combination?

a. Dim - cones.
b. Dim - rods.
c. Bright - cones.
d. Bright - rods.

66. (239) Rods are more sensitive than cones to

a. red light.
b. orange light.
c. yellow light.
d. blue light.

67. (240) Which of the following is the primary cue to depth perception?

a. Perspective.
b. Parallax.
c. Accommodation.
d. Stereopsis.

68. (240) The cure to depth perception that is used when dealing with two-dimensional drawings is

a. perspective.
b. overlay.
c. distant haze.
d. accommodation.

69. (241) Depth perception tests using the VTA-ND, the Verhoeff, or Howard-Dolman apparatus are performed under which of the following conditions?

a. All individuals should be tested without corrective lenses.
b. All individuals tested should wear corrective lenses if applicable.
c. Pilot applicants must wear corrective lenses; other individuals should not wear corrective lenses.
d. Pilot applicants must not wear corrective lenses; other individuals should wear corrective lenses.

70. (241) Which depth perception tester is based on actual depth differences?

a. Howard-Dolman.
b. VTA-ND.
c. Stereofly.
d. Keystone.

71. (242) A patient with 20/30 acuity in each eye is being given the VTA-ND depth test. Using both eyes, the patient reports seeing the head of the arrow very clearly, but not the tail of the arrow. The patient

a. is suppressing.
b. has passed the fusion test.
c. has poor monocular vision.
d. is seeing double.

72. (243) The first scored test group in the VTA-ND depth test is group

a. A.
b. B.
c. C.
d. D.

73. (244) The Verhoeff depth perception test simulates depth by changing the relative size and position of three rods. One rod always appears

a. closer than the other because it is thicker.
b. further than the others because it is thinner.
c. closer or further than the others because it is physically closer or further than the others.
d. closer or further than the others because it is shifted left or right.

74. (244) A passing score on the Verhoeff test is

a. 4/4 correct at 4 meters.
b. 8/8 correct at 16 inches.
c. 8/8 correct at 1 meter.
d. 8/10 correct at 6 feet.

75. (245) The room lighting for the Titmus Stereofly depth perception test should be

a. dim.
b. bright.
c. very dark.
d. normal.

76. (246) The results of the Titmus Stereofly test are recorded in

a. min. of arc.
b. mm of distance.
c. sec. of arc.
d. degrees.

77. (247) Diplopia may be eliminated by

a. suppression.
b. accommodation.
c. aniseikonia.
d. double vision.

78. (248) In the Worth 4-Dot Test, with the left eye covered, the right sees

a. two green dots.
b. two red dots.
c. three green dots.
d. three red dots.

79. (248) While taking the Worth 4-Dot Test, your patient reports the following: "Five dots, three green ones and 2 red ones; the red ones are to the right of the green ones, and the bottom green one is level with the bottom red one." What is your impression?

a. Malingering-anomalous response.
b. High eso tendencies.
c. High exo tendencies.
d. Within normal limits.

80. (248) When taking the VTA-ND Fusion Test, your patient reported seeing the tail of the arrow but not the head. You would not be surprised if, while taking the Worth 4-Dot Test, the patient reported seeing

a. two red dots.
b. two green dots.
c. three red dots.
d. three green dots.

81. (249) The red lens test as described in this text is intended to detect suppression and/or diplopia

a. at nearpoint (16").
b. in color blind individuals.
c. at farpoint (20').
d. when patient is looking in a direction other than straight ahead.

82. (250) Modern theories of accommodation state that during accommodation for near objects the

a. lens assumes a flatter shape.
b. Zonules of Zinn increase their tension.
c. lens becomes more spherical.
d. circular fibers of the ciliary body relax.

83. (250) An elderly person who cannot accommodate for near objects is called

a. a hyperope.
b. a presbyope.
c. an ametrope.
d. an amblyope.

84. (251) The Schirmer Test is designed to measure

a. the amount of tear evaporation.
b. the amount of tears produced.
c. oil gland production.
d. tear drainage.

85. (251) For the Schirmer Tear test, the filter paper should be left in place for

a. 2 minutes.
b. 3 minutes.
c. 4 minutes.
d. 5 minutes.

86. (252) The average normal blood pressure for an adult is

a. 100/98.
b. 110/80.
c. 120/80.
d. 140/60.

87. (252) When taking a patient's blood pressure, you should place the stethescope on the

a. carotid vein.
b. brachial vein.
c. carotid artery.
d. brachial artery.

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 44 USC 3101. PRINCIPAL PURPOSE(S): To provide student assistance as requested by individual students. ROUTINE USES: This form is shipped with every ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. DISCLOSURE: Voluntary. The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance.

SECTION I: CORRECTED OR LATEST ENROLLMENT DATA: MAIL TO: ECI, GUNTER AFS, ALA 36118

1. THIS REQUEST CONCERNS COURSE
2. TODAY'S DATE
3. ENROLLMENT DATE
4. PREVIOUS SERIAL NUMBER
5. SOCIAL SECURITY NUMBER ☐☐☐ – ☐☐ – ☐☐☐☐
6. GRADE/RANK
7. INITIALS ☐ ☐ LAST NAME
8. OTHER ECI COURSES NOW ENROLLED IN
9. ADDRESS: (OJT ENROLLEES - ADDRESS OF UNIT TRAINING OFFICE/ALL OTHERS - CURRENT MAILING ADDRESS)

ZIP CODE ☐☐☐☐☐

10. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE:
11. AUTOVON NUMBER
12. TEST CONTROL OFFICE ZIP CODE/SHRED

SECTION II: Old or INCORRECT ENROLLMENT DATA

1. NAME: 2. GRADE/RANK: 3. SSAN:
4. ADDRESS: 5. TEST OFFICE ZIP/SHRED:

SECTION III: REQUEST FOR MATERIALS, RECORDS, OR SERVICE

(Place an "X" through number in box to left of service requested)

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. The latest course workbooks have a Form 17 printed on the last page.

1 EXTEND COURSE COMPLETION DATE. (Justify in Remarks)
2 SEND VRE ANSWER SHEETS FOR VOL(s): 1 2 3 4 5 6 7 8 9 - ORIGINALS WERE: NOT RECEIVED, LOST, MISUSED
3 SEND COURSE MATERIALS (Specify in remarks) - ORIGINALS WERE: NOT RECEIVED, LOST, DAMAGED.
4 COURSE EXAM NOT YET RECEIVED. FINAL VRE SUBMITTED FOR GRADING ON (Date):
5 RESULTS FOR VRE VOL(s): 1 2 3 4 5 6 7 8 9 NOT YET RECEIVED. ANSWER SHEET(s) SUBMITTED ON (Date):
6 RESULTS FOR CE NOT YET RECEIVED. ANSWER SHEET SUBMITTED TO ECI ON (Date):
7 PREVIOUS INQUIRY (ECI FORM 17, LTR, MSG) SENT TO ECI ON:
8 GIVE INSTRUCTIONAL ASSISTANCE AS REQUESTED ON REVERSE:
9 OTHER (Explain fully in remarks)

REMARKS: (Continue on Reverse)

OJT STUDENTS must have their OJT Administrator certify this request.

ALL OTHER STUDENTS may certify their own requests.

I certify that the information on this form is accurate and that this request cannot be answered at this station. (Signature)

ECI FORM 17 JUN 77 PREVIOUS EDITIONS MAY BE USED

SECTION IV: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of textual material should be forwarded directly to preparing agency. Name of agency can be found at the bottom of the inside cover of each text. All other inquiries concerning the course should be forwarded to ECI.

VRE ITEM QUESTIONED:

MY QUESTION IS:

Course No. __________

Volume No. __________

VRE Form No. __________

VRE Item No. __________

Answer You Chose
(Letter) __________

Has VRE Answer Sheet
been submitted for grading?

☐ YES ☐ NO

REFERENCE
(Textual support for the
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OPTOMETRY SPECIALIST

(AFSC 91255)

Volume 3

Spectacle Related Procedures

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Preface

VOLUME 3 of CDC 91255, *Optometry Specialist*, is concerned with the types of frames available, types of lenses available, and the procedures to order spectacles and set up a logbook. This volume covers prescription verification, fitting, and repairing, along with dispensing the final spectacles to the patient. There is also a review of using the lensometer and about lens aberrations.

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Material in this volume is technically accurate, adequate, and current as of April 1982.

Acknowledgement

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CHAPTER 1

Spectacle Fitting and Repairing

AMONG THE MOST frequently performed tasks in the 912X5 career field are the fitting, ordering, dispensing, and repair of glasses. These also happen to be among the most important functions of your civilian counterpart. Whether or not you plan on making a career as a dispensing optician or paraoptometric technician, it would be to your advantage to learn the fundamentals well.

1-1. Frame Availability and Construction

Our civilian counterparts would call this section frame selection and delve into the theory and practice of frame shapes, colors, facial attributes, etc. Our selection in the military is limited mainly to the S–10 and S–14 frames, which are available in any color a patient desires, as long as the patient wants black.

400. Define and describe the S–10 frame in terms of use, construction, and size.

Frame Construction. You have probably had the experience of hearing an E–8 or E–9 patient reminisce about the "good old days" when they wore the military pink frame, and how they dyed it black. The pink frame was actually the second style to be used in the military, the first being a steel wire frame with a P–3 shape and riding bow temples. The steel frame was replaced with a cellulose nitrate pink plastic frame with an S–7 shape and a skull temple. Cellulose nitrate frames were fairly durable, but they had a tendency to burn rapidly when exposed to fire (cellulose nitrate is made from nitrocellulose and camphor). British opticians named this stuff "xylonite (or zylonite)," from which we get the expression "zyl" for all plastic frames.

About this time, pilots and navigators were being issued gold-filled aviator's goggles with a deep teardrop shape and green Ray-Ban lenses.

Sometime in the late 1950's, DOD changed to a grey cellulose acetate S–7 frame and a slightly different shape for its flying goggles. (Cellulose acetate happens to be a thermoplastic plastic made from a chemical treatment of wood pulp.) In the early 1970's, DOD, deciding that the frame style should be changed again, changed the issue item to an S–10 black frame. Let's look at the styling and construction of the latest military-issue spectacle frames. (See fig. 1-1.)

Nomenclature. It is surprising how many people are ignorant of the nomenclature of their frame, even though they may have been wearing glasses for many years. You won't find many people calling an automobile differential "the thing that makes the wheels go around," but a simple thing like a temple may be called anything from an earpiece to a wing. optometry specialists have gotten into the habit of calling a part by the name the patient gives it instead of using the proper terminology. You should use the proper terminology in your job; you'll find that the patients will soon learn the right names too. Figure 1-1 correctly names most of the parts of a frame. Learn them.

Types of frames. There are four military frame styles available: the S–10 (male), the S–14 (female), the half-eye or see-over, and the aircrew spectacle frame. We'll discuss each as to construction, use, and sizes available.

S–10 refers to the shape of the pattern used to cut the lens for the frame. The lens certainly doesn't look like an "S," but the number 10 has some significance: the difference between the width and height of the lens is 10 millimeters (mm). In other words, a lens cut to fit a 48 eye size, S–10 frame is 48 mm wide and 38 mm high. The S–14 female frame has a difference of 14 mm; a lens 46 mm wide is only 32 mm high.

The nose pads on an S–10 or S–14 frame can be either of a rigid or adjustable type. The bridge is a keyhole shape, which differs from the saddle shape of many civilian frames and the military half-eye.

The hinge is a 5-barrel hinge; this means that it has five metal rings (three on the temple and two on the front). The aircrew frame hinge is of a 3-barrel construction, whereas many civilian frames are of a 7-barrel construction.

S–10 frame temples are available in the paddle style or in the comfort cable style. (See fig. 1-2.) Aircrew frames are available with bayonet or comfort cable temples. All military temples are measured from butt to bend, whereas most civilian temples are ordered in a length corresponding to that from butt to tip. (See table 1-1.) The only exceptions are the comfort cable (riding bow) temple and the aircrew bayonet and comfort cable temples, which are measured from butt to tip.

All frame front dimensions are measured in millimeters (mm), and this measurement is stamped on the front. Temple length is measured in inches and the size is stamped on the temple. Thus, a 46/20/4 1/2 frame means that the eye size or lens diameter is 46 mm, the bridge width (sometimes called DBL or distance between lenses) is 20 mm, and the length of the temple from butt to bend is 4½ inches. However, with the advent of metrication you may soon see temple lengths in millimeters, which is the case now for many civilian frame companies.

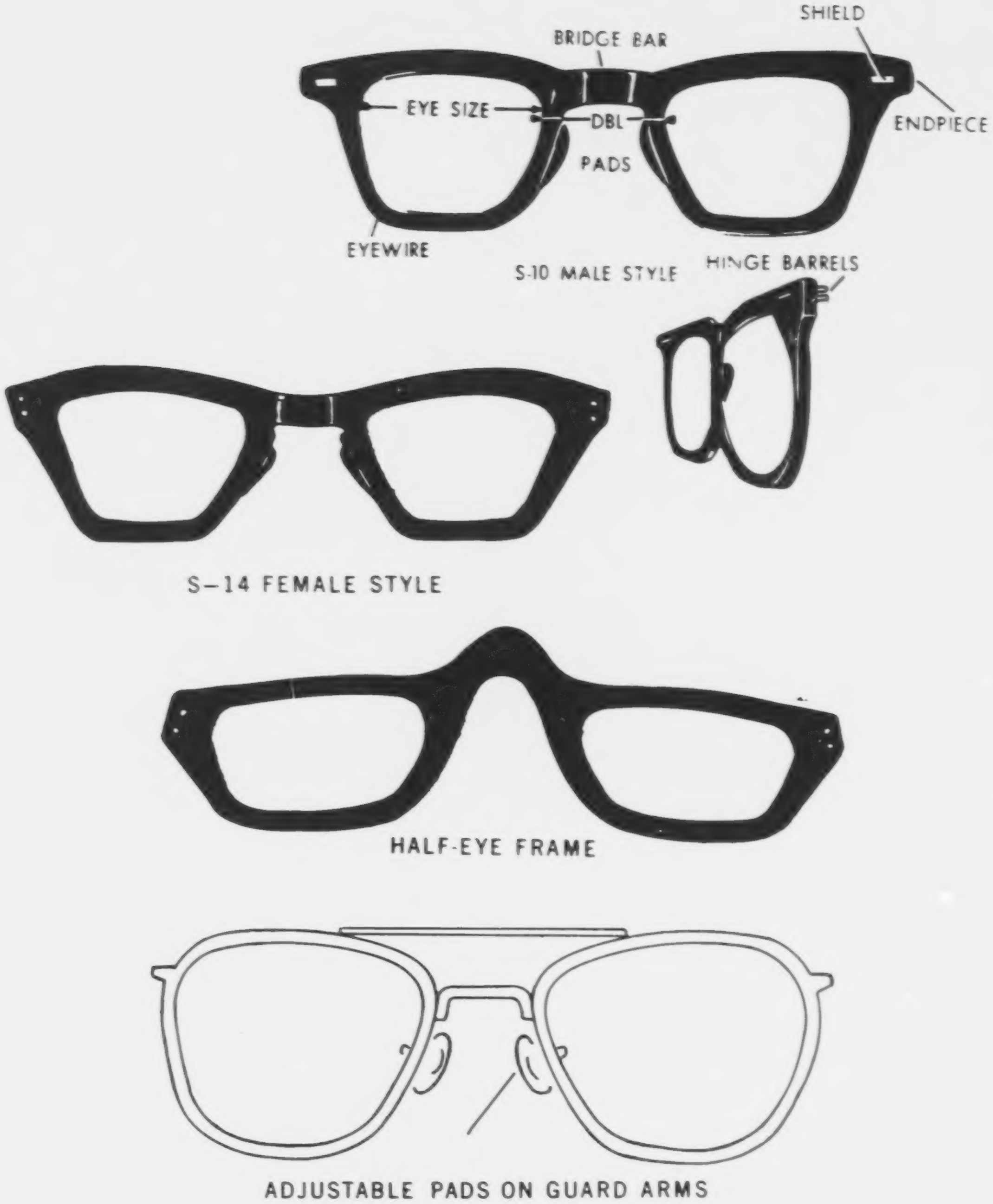

SHIELD
BRIDGE BAR
EYE SIZE
DBL
PADS
ENDPIECE
EYEWIRE
S-10 MALE STYLE
HINGE BARRELS
S–14 FEMALE STYLE
HALF-EYE FRAME
ADJUSTABLE PADS ON GUARD ARMS

Figure 1–1. Military issue spectacle frames.

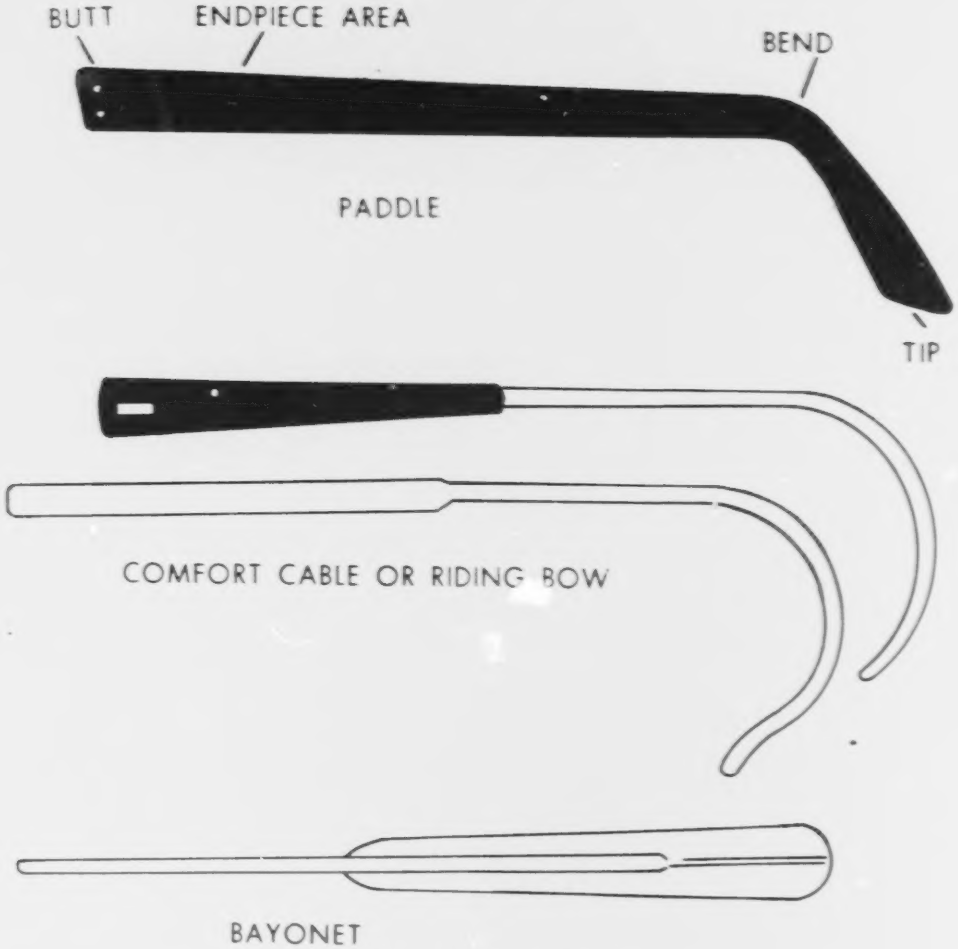

BUTT
ENDPIECE AREA
BEND
PADDLE
TIP
COMFORT CABLE OR RIDING BOW
BAYONET

Figure 1–2. Standard military temple styles.

TABLE 1–1
TEMPLE LENGTHS

NUMBER STAMPED ON TEMPLE	"CIVILIAN SIZE"	"MILITARY SIZE"	TYPE
4 - 5 1/4	5 1/4	4	Paddle
4 1/4 - 5 1/2	5 1/2	4 1/4	Paddle
4 1/2 - 5 3/4	5 3/4	4 1/2	Paddle
4 3/4 - 6	6	4 3/4	Paddle
5 - 6 1/4	6 1/4	5	Paddle
4 1/4 - 6 1/4	6 1/4	6 1/4	Comfort Cable
4 1/2 - 6 1/2	6 1/2	6 1/2	Comfort Cable
4 3/4 - 6 3/4	6 3/4	6 3/4	Comfort Cable

A third type of frame is available from military ophthalmic labs—the half-eye or see-over type of frame. Designed specifically for use by essentially emmetropic presbyopes, this frame is available in one size (approximately 44/24). (See fig. 1-1.)

The fourth frame available to the patient is the aircrew spectacle frame. This frame is restricted issue and can be ordered only for authorized individuals as listed in AFR 167–3, Medical Services Ophthalmic Services. Only one size is available (52/20), but substitute comfort cable temples may be ordered in place of the standard bayonet temples. (See fig. 1-1.)

Although the selection of military frame styles in CONUS is extremely limited, a wider selection exists under the Special Order Spectacle Program overseas, and if given an oversea assignment, you will have greater opportunity to fit civilian-styled frames.

Exercises (400):

1. What does the term "S–10" mean?

2. What is the primary advantage of cellulose acetate over cellulose nitrate plastics?

3. With temple dimensions of 4½/5¾, which size stamped on the temple would be used for military orders, and which size would be used for civilian orders?

4. What is the standard frame size for the aircrew frame?

5. What is the standard frame size for the half-eye frame?

1-2. Military Lens Availability

Several different types of lenses are available for use by military optometrists. These types can be broadly classified into single-vision and multifocal.

401. Specify characteristics of ophthalmic lenses.

Lens-toughening Procedures. Shatter-resistance depends upon lens material, thickness, and internal stress patterns.

Material. As mentioned earlier, lenses can be fabricated in either glass or plastic (CR–39). Army optical labs usually fabricate any lens of over ± 5.00 diopter sphere (D sph), cylinders over ± 4.00 D, or a difference of 4.00 D between the lenses in plastic. The Navy fabricates nearly all powers in plastic. The type of plastic used is heat resistant, but it will warp slightly and is subject to greater surface scratching than is an equivalent glass lens. The plastic has a higher molecular bond strength than glass and is more shatter-resistant than is an equally thick glass lens. The plastic lens is also about one half the weight of an equally thick glass lens.

Thickness. This much is fairly obvious: the thicker a lens, whether of glass or plastic, the greater the resistance to breakage. The minimum thickness for dress safety glass lenses is about 2.0 mm, while the minimum thickness for industrial safety glass lenses is about 3.0 mm.

Strengthening. A method of glass lens toughening is immersing the lens overnight in a hot chemical solution that chemically alters the composition of the surfaces of the lens, thus toughening it. This process is faster and less expensive, and the results are a stronger lens. The old method of heat treatment by baking the lens is seldom used unless requested.

In any event, all toughened lenses are identified as such by a stamp on the Rx accompanying the spectacles. This stamp reads "Heat Treated Glass," "Chemically Treated Glass," or "Plastic Lenses." The Food and Drug Administration (FDA) requires that all spectacles be shatter-resistant.

Tints. At the present time, the only standard tints available are the N–15 and N–31 neutral grey shades. The N–15 transmits about 15 percent of the incident light, while the N–31 transmits about 31 percent. Both types have relatively low color distortion since they absorb fairly evenly over most of the visible spectrum.

Antireflective Coatings. Antireflective coatings are available for glass lenses only. Glass lenses transmit about 92 percent of the incident light (8 percent is reflected or absorbed), while plastic (CR–39) lenses transmit from 89 percent to 92 percent. A 1/4-wavelength-thick magnesium fluoride coating on the surface of the glass lens improves its transmission to about 97 percent.

Exercises (401):

1. When glass is not used for ophthalmic lenses, what other material is?

2. Which lens "toughening" process alters the composition of the surface of the lens?

3. What are the percentages of light that can be transmitted through the two neutral gray tints?

4. What is the antireflective coating called that is put on clear glasses to increase the percentage of light transmitted?

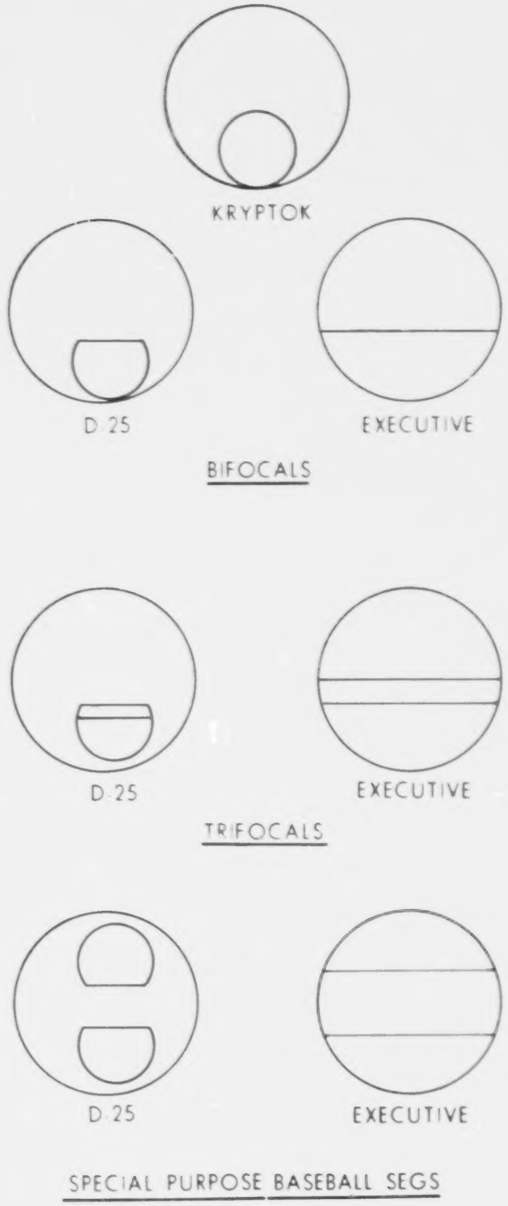


Figure 1-3. Multifocal lens styles.

402. Specify types, factors in selecting, and the measurement of segment heights for multifocal lenses; and state characteristics of single-vision lenses.

Multifocal Lenses. Multifocal lenses are those lenses which are designed for either *two* primary working distances (bifocal) or three (trifocal). Army optical labs supply multifocal lenses in glass or plastic (plastic is supplied if the sphere reading of the distant portion is over ±5.00). Again, the Navy fabricates nearly all lenses for S-10 and S-14 frames in plastic. Multifocals are available in the same tints and coatings, as are single-vision lenses.

Types of multifocals. Four basic types of multifocals are available from the military optical labs as follows (see fig. 1-3):

(1) Kryptok—a 22 mm round segment, used in some spectacles on request.

(2) D-25—a 25-mm flattop segment, which is the standard issue.

(3) Executive—a straight-line bifocal that covers the entire lower part of the lens (military labs stock this lens but special justification is needed to order it).

(4) D-35—a 35 mm flattop segment, justification needed also, usually to replace executive.

Both the Kryptok, D-25 and D-35 bifocals are known as fused bifocals, because the segment is actually glass of a higher index of refraction, fused or melted into the carrier lens. The Executive bifocal is one piece in that the difference in power through the segment is not due to differing indices of refraction but due to different radii of curvature. Since the radii of curvature of the two sections of the lens are different, a visible (and palpable) line is noted at this common boundary.

The Executive, D-35, and D-25 styles are also available as trifocals. Intermediate segment heights are 6 or 7 mm, depending upon the blank used, and intermediate segment powers can be ordered as 50 percent or 66 percent of the reading portion. A 50 percent intermediate is standard.

A special-purpose lens, such as a double-segment Executive bifocal, or double-segment ST-25 bifocal, may be ordered for occupational use. The top reading segment is usually weaker than the bottom reading segment. These segments are usually 13mm apart on the D-25 and 14 mm apart on the Executive above and below the distance portion of the Rx.

Multifocal problems and problem patients. How many of your bifocal-wearing patients have returned to the clinic with complaints of too high, too low, too big, or too small segments? How many folks have complained of the segment being in the way when walking down stairs and, at the same time, too low for reading? What can you, as the dispenser, do about these problems?

a. Correct multifocal height. How many of your bifocals are ordered with a 17 mm segment height, or maybe a 3 BOC below optical center segment height? Are these the bifocals that patients are returning with complaints? Let's look at one way to measure the segment height and at some possible modifications to what you have measured. Figure 1-4 shows the points of reference that you should use in measuring multifocal height. The bifocal line is usually measured from just below the inner edge of the lower eye wire to the lower limbus, whereas the trifocal is usually measured to the lower pupillary margin. Once you have measured this basic distance, you must consider how patients are going to use their bifocals. If the patient will use them mainly for reading purposes, you may consider a 1- or 2-mm increase in bifocal height. In contrast, driving glasses may have a reduced bifocal height.

Some patients complain of "seeing the line" of their bifocals. In response, many specialists reorder the next pair for each such patient with lower segments. Yet, if "seeing the line" is the patient s only complaint, a lower segment

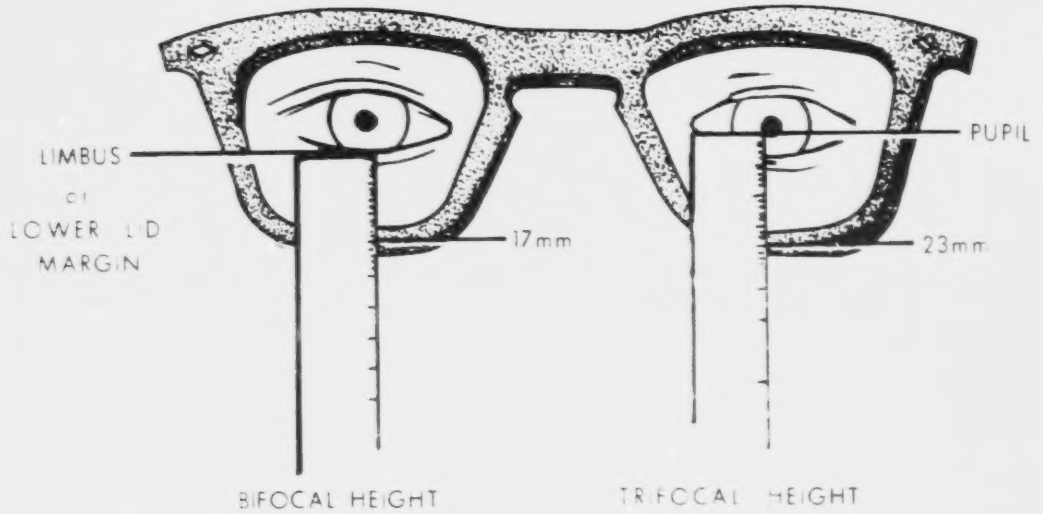


Figure 1–4. Measuing multifocal height.

may *not* alleviate it. After all, the bifocal line is always visible if one looks for it.

Interestingly enough, hyperopic presbyopes usually accept a higher segment height than do myopic presbyopes. The reason for this is, perhaps, that the hyperopic presbyopes use their bifocals mainly for reading, while the myopes use their glasses mainly for distance.

When ordering new bifocals for a patient who has worn them before, it is a good practice to order them so that the bifocal line position (relative to the eye) corresponds to the same position as that present in their old bifocals.

b. Bifocal inset. Bifocal inset is most often computed from the near interpupillary distance (PD). In this process, you simply subtract the near PD from the far PD and divide by 2. Some specialists compute inset by subtracting 3 from the far PD and using a standard 1½ mm inch for each eye. This does work out to be a good, safe average.

Many early presbyopes don't like to admit that they need bifocals. Sometimes the term "bifocal" makes them think of their age and the deterioration of their eyes. Consequently, it is good psychology to remember that, when dealing with these patients, you should be very kind and tactful. Explain to them that they are experiencing a natural part of life; no one can avoid it if they live long enough. Explain how much better life will be when they can pick something up to read and not have to shift it all around to get it into focus. Doing this, you may be surprised at the way people accept the glasses when it's time to pick them up. They may actually be excited about getting them. They also won't come back as often to get them readjusted.

Exercises (402):

1. Which type lens has three primary working distances?

2. What factor governs the Army's supplying of plastic multifocals?

3. Which multifocal is the standard-issue style?

4. What percentage of the reading portion are most intermediate powers?

5. What is the base line for measuring a bifocal?

6. What is the measurement of the average monocular bifocal inset?

1-3. Frame Fitting Information

In this area of study, the time a doctor spends with a patient could be in vain or worthwhile depending on you. You have to be able to fit a patient with the most comfortable spectacles possible. When this is not done, the patient will not wear them or will gripe constantly about them. If this happens, what progress has been made toward patient care?

TABLE 1-2

AVAILABILITY OF MILITARY FRAMES SIZES

S-10 "Male" Fronts
Eye Size: 44, 46, 48, 50
Bridge Size: 20, 22, 24, 26

S-14 "Female" Fronts
Eye Size: 44, 46, 48
Bridge size: 18, 20, 22, 24

Paddle Temple Lengths (to bend)
4", 4 1/4", 4 1/2", 4 3/4", 5"

Riding Bow (cable) Lengths (overall)
6 1/4", 6 1/2", 6 3/4"

Aircrew Front Size: 52/20 (eyesize 52 X 20)

Aircrew Bayonet Temple Size: 4 1/4"

Aircrew Comfort Cable Size: 6 1/2" (overall)

Half-eye Front Size: 44 - 24 (standard)
Temple size: 4 1/2" (straight back)

403. List structural variables and fitting criteria of spectacle frames, and in specific situations, compute maximum monocular decentration and induced prismatic effect after decentration.

Frame Fitting Criteria. No matter how much work the optometrist does in refining a prescription, a patient will not wear the glasses unless they fit comfortably and appear cosmetically enhancing. (They must look good and feel good as well as see good.) Three criteria that assure patients a comfortable fit are the selection of the appropriate eye size, bridge size and type, and temple length and type. Table 1-2 shows the sizes available in military frames.

Eye size. Since wearing glasses is "in" now, most patients have some idea of how they should look in a frame. Because the present style trend is toward large eye sizes in both plastic and wire frames, many patients will pick out a frame that may look excessively large in the military style. You may want to go along with the patient's desires regarding frame size, but remember that you are the person who must bend the frame so that it fits comfortably. An overlarge frame fits loosely, and you may end up spending an inordinate amount of time tightening the frame.

A second consideration in ordering large eye sizes is the possibility of decentration error. Army optical labs are limited to lens blank sizes of 58 and 62 mm. If an order requires an amount of decentration needing a lens blank larger than that in stock, the lab will local purchase a larger blank, resurface a stock lens with prism, or decenter as much as possible. Usually, the lab will take the easy way out and try maximum decentration, which may not be enough to eliminate all unwanted prismatic effect. Let's investigate eye size vs lens blank size.

Consider, for example, Staff Sergeant John Crowder who has chosen a frame with a 50/24 front. His interpupillary distance (PD) is 65 mm, and his Rx is −5.00 ocular uterque OU. Should you order a frame of that size?

Decentration (d) = (frame PD − patient's PD) ÷ 2
d = (FPD − PPD) ÷ 2
d = (50 + 24 − 65) ÷ 2
d = 9 ÷ 2
d = 4½ mm in. for each lens

Assume that the lab has only 58 mm lens blanks in stock. The eye size is 50 mm; thus, the lens could be decentered a maximum of: (58 − 50) ÷ 2 = 4 mm. A realistic 1 mm edging allowance would reduce this figure to 3 mm. (See fig. 1-5.) But, SSgt Crowder needs 4½ mm decentration and can obtain only 3 mm; therefore, there is a 1½ mm decentration error for each lens or a total of 1½s6^{Δ} base-in prismatic effect for both −5.00D lenses. This induced prism could: (1) cause symptoms of walking up or down a slope, (2) interfere with depth perception, and (3) cause headaches. Table 1-3 shows maximum decentration available for all frame sizes and the two stock lens blank sizes. If you need more decentration than that shown in the table, compute induced prismatic effect to see whether or not the prism could influence the patient's comfort.

Prismatic effect = Diopters (D) of lens power in the horizontal meridian times decentration (D) in centimeters (cm)

$\Delta \times d(cm)$

Example 1: Technical Sergeant Joan Hainline, an 8.00 D hyperope, has chosen a 48/22 frame, her PD is 60 mm, and the lab is limited to 58 mm lens blanks. If TSgt Hainline insists on this frame size, what would be the induced prismatic effect? Is this effect tolerable?

d = (FPD − PPD) ÷ 2
= (70 − 60) ÷ 2
d = 5 mm; maximum d from table 1-3 is 4 mm; therefore, a 1 mm decentration error will exist.
Δ = D × d(cm)
= 8.00 × 0.1 (1 mm = 0.1 cm OR 1 mm ÷ 10)
Δ = 0.8^{Δ} primatic effect for each eye, or 1.6^{Δ} total. This amount could lead to initial adaption problems and should be considered excessive.

Example 2: Colonel Baum, a navigator, needs −1.00 spheres in his N−15 sunglasses; his PD is 64 mm. Are there any induced prism effects in the Rx? (Assume a 62 mm lens blank.)

d = (FPD − PPD) ÷ 2
= (72 − 64) ÷ 2
d = 4 mm; maximum d from table 1-3 is 4 mm; therefore, no decentration error will result.

NOTE: American National Standard on recommendations for prescription ophthalmic lenses, otherwise known to you as Z80.1-1979 or ANSI Standards, gives us some guidelines on what is acceptable and what isn't. According to their new book, a vertical imbalance of more than $1/3^{\Delta}$ or more than 1 mm difference in height

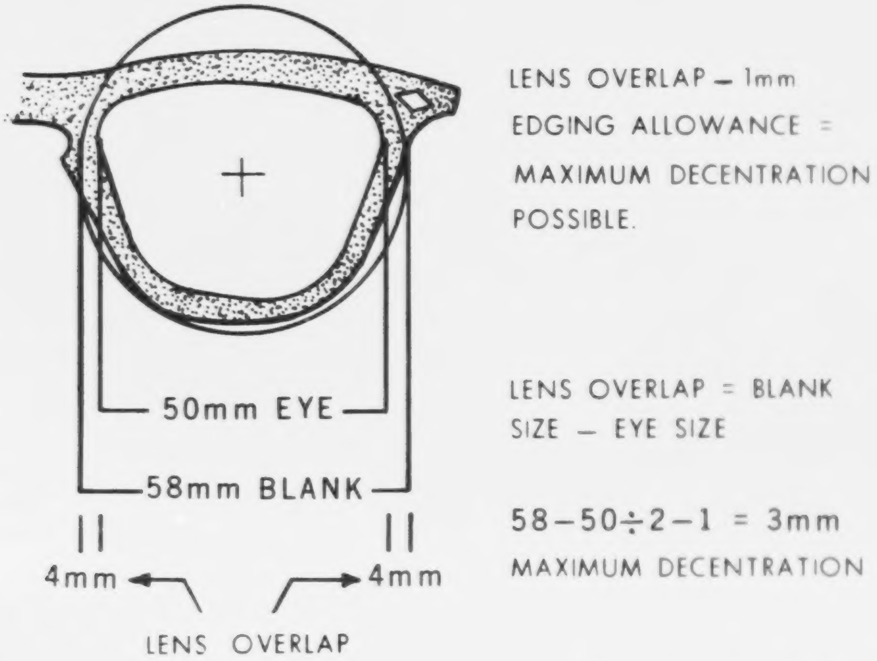

LENS OVERLAP – 1mm
EDGING ALLOWANCE =
MAXIMUM DECENTRATION
POSSIBLE.
50mm EYE
58mm BLANK
LENS OVERLAP = BLANK
SIZE – EYE SIZE
58–50÷2–1 = 3mm
MAXIMUM DECENTRATION
4mm
4mm
LENS OVERLAP

Figure 1–5. Available decentration for a lens blank.

(vertical level) between the optical centers is unacceptable. Total horizontal imbalance for both lenses should not exceed $2/3^{\Delta}$ or more than 2.5 mm variance from patient's PD, if it does it's not acceptable.

Bridge size and type. Several important considerations are included in the selection of a proper bridge fit. First, the bridge must fit comfortably; it should not be so wide as to leave a space between one pad and the nose, nor should it be so narrow as to cause excessive red spots to form on the nose. Second, the bridge size should be adjusted to spread the frame weight evenly across the widest area possible. Then the bridge size should be adjusted to allow the upper rim of the front to correspond with the eyebrow.

Two types of pads are available on military bridges—the keyhole bridge, with either rigid pads or adjustable pads, and the aircrew (wire) bridge with adjustable pads. Selection of a rigid or adjustable pad should be made on the basis of nose shape and lens-eyelash distance. Extremely flat or small noses usually need the adjustable type, as does the frame in which the eyelashes strike the back of the lenses. The half-eye only comes with the saddle type bridge which really doesn't have pads.

Temple type and length. Three temple types are available for various military frames. They may be classified as straight (standard aircrew, and half-eye), bent or "paddle" (S–10), or curved (comfort cable aircrew and S–10). The

TABLE 1–3

MAXIMUM DECENTRATION TABLE

Eye Size (mm)	Lens Blank Diameter (mm)	
	58	62
44	6	8
46	5	7
48	4	6
50	3	5
52	2	4

straight temples are available in only one standard size, so no selection is necessary. Because the bent and curved temples are available in various sizes, the proper length must be determined before ordering the glasses. Determination of temple length is usually done by trial and error from your sample frame selection. After your first thousand pairs, it will become an educated guess. The beginning of the bend or curve should be just behind the top part of the ear where it touches the temporal area of the head.

Exercises (403):

1. What structural variables of a spectacle frame must be considered in preliminary fitting procedures?

2. Using table 1-3, determine the maximum monocular decentration possible for each of the following frames:

    a. 44/20.

    b. 48/20.

    c. 46/24.

    d. 52/20 (Aircrew frame).

    e. 50/22.

    f. 44/26.

3. Compute the induced prismatic effect after decentration in each of the following cases, assuming you're using a 58 mm lens blank.

    a. OD −2.00 −2.00 × 90
    OS −3.50 sph
    PD: 59; frame: Aircrew

    b. OD +6.50 sph
    OS +7.50 sph
    PD: 62; frame: 48/22

4. What is the maximum allowable vertical and horizontal induced prism imbalance for monocular and binocular lenses, as set forth by the Z80.1 commission?

1-4. Fitting Optical Inserts in Military Protective Masks

Many AF agencies require the occasional use of gas masks by their personnel. Some of these people have poor visual acuity. Part of your job is to obtain gas mask inserts so that the patient can see while wearing a gas mask.

404. Identify gas mask fitting procedures.

M–17 Protective Mask. Several chemical-biological (gas) masks are in use in the Air Force today. One of the most common is the M–17 protective mask. (See fig. 1-6.)

Your supervisor may rattle on about how he or she used to take the M–17 gas mask kit and go through a tedious trial and error method of selecting the correct position of the insert. That is history now. The Army and Navy Ophthalmic Labs are using only one size on the M–17. There is no more guessing or messing. Just state in the Remarks section of a DD Form 771, Eyewear Prescription, that you need an M–16 gas mask insert. The frame PD is 70 mm.

Method of attaching insert. To attach an insert, first snap the headstrap of the mask over the front of the facepiece and fold back the edges of the mask so that you can get to the inside of the mask eyepieces easily. Grasp the plastic-covered tabs on the frame, and insert the lower section of the frame into the channel in the lower section of the mask eyepiece. Then spring the upper section down and into the upper channel of the mask eyepiece. Repeat the same procedure for the other side of the snap-in frame.

To remove the insert, grasp the plastic-covered tabs and pull the upper section of the frame down and out of the mask eyepiece channel. Remove each frame assembly individually. In handling the insert, be careful to keep fingerprint smudges from the insert lenses and inner surface of the eyepieces. When the opportunity arises, you'll find that the M–17 A1 Gas Mask has the same kind of channel, so when individuals that order the insert aren't sure which mask they're using, the M–17 will fit inside either one.

Adjusting pantoscopic tilt. The desired pantoscopic tilt and vertex distance adjustment may be achieved by first loosening the set screws in the temporal strut housings and then removing the binocular lens assembly. To obtain the correct pantoscopic tilt, grasp the temporal struts close to the eyewires with optician's adjustment pliers; then bend the struts to the required angle. The vertex distance may be controlled by inserting the temporal struts into the temporal strut housings the required depth and then firmly tightening the set screws.

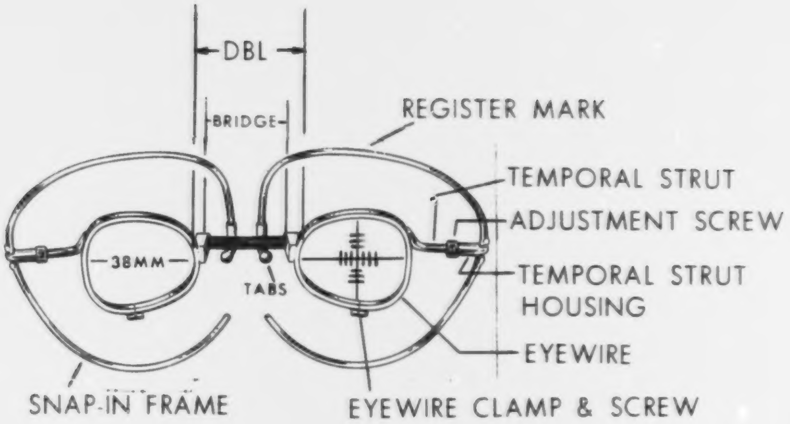


Figure 1-6. M-17 protective mask insert.

M-14A2, M-17A1, and M-25 Masks. Another common insert is the M-17A1 insert for the M-14A2, M-17A1, or M-25 masks. This insert (shown in fig. 1-7) is available in a universal size to fit all patients wearing the above mentioned masks. When ordering this type of insert from the lab, state the type of mask in the Remarks area of the DD Form 771. Do not confuse the M-17A1 and M-17 inserts. The plastic M-17A1 insert fits the M-17A1, M-14A2, and M-25 masks, but *not* the M-17 mask. The frame PD is 66 mm.

Full-Face Respirators. Some personnel use a full-facepiece respirator, like firefighters. They sometimes have trouble getting a good seal around the temple area, which could be hazardous to their health. There is a suggested way to modify a stocklisted frame as follows (see fig. 1-8):

(1) Select a 44/22 front to contain the lenses.

(2) Select temples of the proper length.

(3) Remove the plastic from the temple reinforcement wire.

Remember to tape the plastic where it touches the wire, or use acetone to smooth and seal the cut ends. (A desirable alternative may be to use aircrew frame cable temples.)

One pair of modified spectacles of this type is authorized to those individuals who have uncorrected vision poorer than 20/30 in their best eye and require the use of full-facepiece respirators in the performance of their duties.

Chemox Respirators. Many emergency crews use a Chemox respirator. If the flight surgeon recommends that some of these personnel need glasses while wearing the Chemox mask, you are authorized to provide the following services:

(1) Request that the patient's supply unit order the Chemox insert (Spectacle Assembly, 4240-00-781-6318) and forward it to your clinic. (See fig. 1-9.)

(2) Send the insert and patient's Rx on a DD Form 771 to the optical lab at Denver, Colorado.

(3) Notify the patient when the insert comes back from the lab. The patient then takes the Chemox insert and installs it in the Chemox breathing apparatus according to the instructions included with the insert.

Oxygen Masks. Some patients have difficulty wearing aircrew spectacles with an oxygen mask. A few simple procedures can help alleviate this problem. One way is to order on the DD Form 771, down in the Special Lenses or Frame section, a modified zyl frame for use with oxygen mask. This frame is a 50-26 with a stretched and reshaped bridge to help the mask fit properly. Another procedure is to remove the adjustable pads and guard arms from the patient's aircrew frame. The next depends on the type of mask being used. The Scott Air Pack has a special gadget with a suction cup on it that is attached to a regular S-10 frame. The frame can be ordered from the lab, the special attachment can be local purchased by the unit using the mast. For more information call us.

If a patient has problems wearing an aircrew frame with a full-pressure-suit helmet, adjust the frame as follows:

(1) Bend each temple inward about 45° at a point one-half inch behind the butt.

(2) Bend each temple outward about 45° at a point one-half inch behind the bend described above.

(3) Fit the spectacles under the helmet and make any necessary final adjustments.

Ordering Criteria. If you are wondering how you might obtain some of these fashionable gas mask inserts, here are the visual acuity (VA) qualifications:

(1) Less than 20/20 for flight personnel.

(2) Less than 20/40 for vehicle operators.

(3) Less than 20/70 for all other personnel.

Accountability. Optical inserts for military protective masks are considered personal items and accompany the individual when transferred.

Exercises (404):

Suppose you are assigned to an area where personnel are required to wear gas masks occasionally. It would be your duty to provide inserts for the gas masks for those personnel who require spectacles. Indicate whether each of the following statements pertaining to the selecting, attaching, and adjusting of inserts for gas masks is true or false:

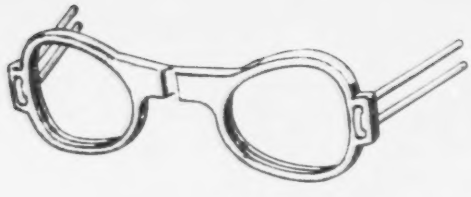
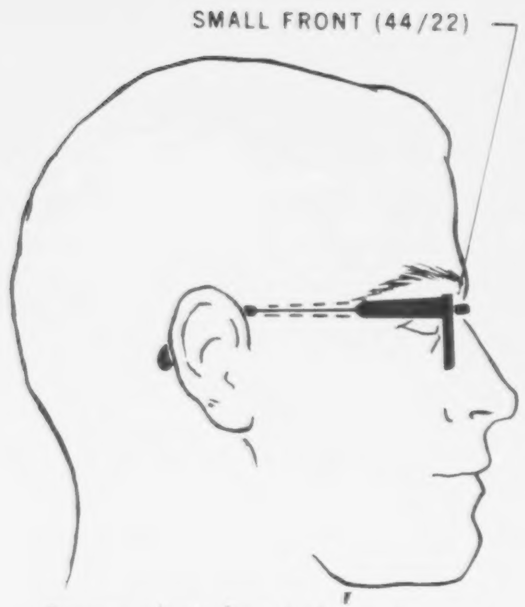


Figure 1-7. M-17A1 optical insert.



Remove plastic from both temples in area indicated by dashes.

Figure 1-8. Modified zyl frame.

T F 1. The M-17 and M-17A1 inserts are interchangeable.
T F 2. The M-17 does not require special measurements.
T F 3. The M-17A1 has a plastic rim.
T F 4. The frame PD on the M-25 insert is 68 mm.
T F 5. There isn't any standard insert available for the Chemox. T F 6. The modified zyl frame for the oxygen mask is a 48-22.

1-5. Frame Adjustments and Repairs

All frames sent from the lab have to be individually fitted to the patient. Many times this careful adjustment will be spoiled by some accident. To avoid such accidents, you should be skilled in all frame adjusting procedures. Such skill will also allow you to make rapid, durable modifications. In this regard, before adjusting a frame, you must know what tools are available and what procedures you should use.

405. Name the tools and state the procedures to use in making given frame adjustments; and summarize the major steps in fitting frames.

Tools. The handiest tool in the optometry clinic seems to be the Mark I digital manipulative extension set, commonly known as *fingers*. This tool requires extreme care when handling hot or sharp objects and may not be suitable for some jobs. Recommended optical tools for specific jobs are listed below. (See fig. 1-10.)

Axis alignment pliers. Use the axis alignment pliers for cylinder axis alignment in the zyl frame. The frame must be warm when you attempt to rotate the lenses.

Cutting pliers. Use these pliers to cut long screws, eye wires, and other items in the optometry clinic.

Temple angling pliers. Use the temple angling pliers for temple adjustment, endpiece adjustment, or 4-point alignment.

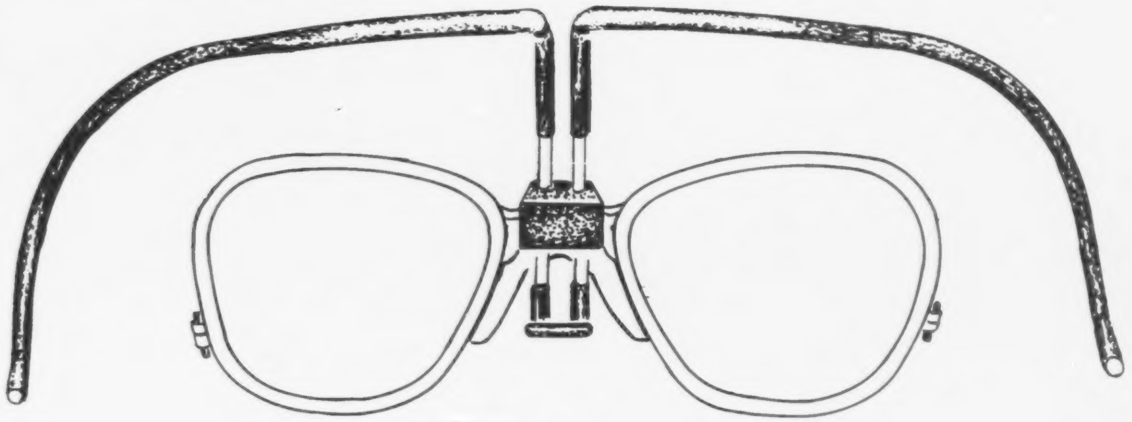


Figure 1-9. Chemox respirator spectacle kit.

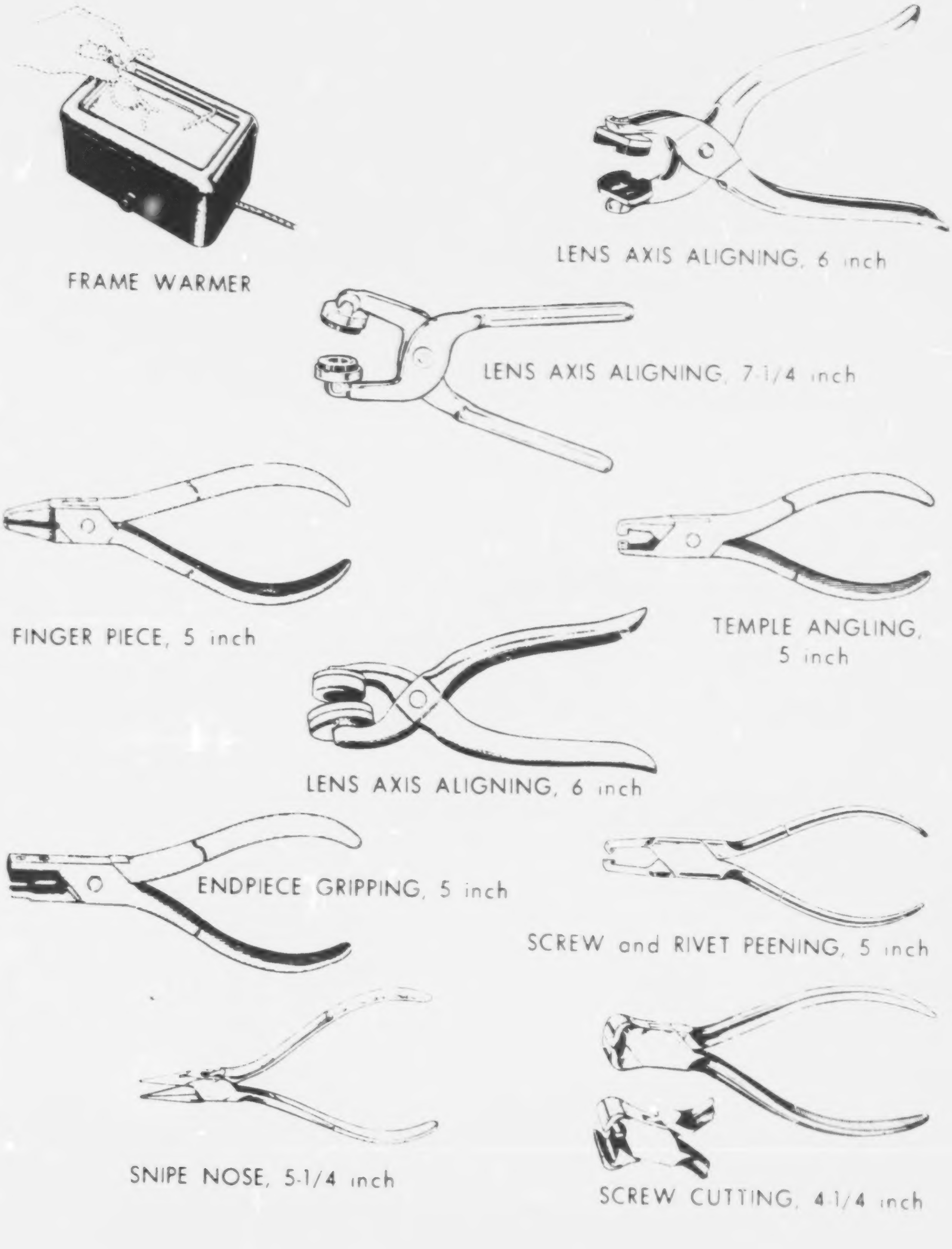

FRAME WARMER
LENS AXIS ALIGNING, 6 inch
LENS AXIS ALIGNING, 7-1/4 inch
FINGER PIECE, 5 inch
TEMPLE ANGLING, 5 inch
LENS AXIS ALIGNING, 6 inch
ENDPIECE GRIPPING, 5 inch
SCREW and RIVET PEENING, 5 inch
SNIPE NOSE, 5-1/4 inch
SCREW CUTTING, 4-1/4 inch

Figure 1–10. Optical tools.

Snipe nose pliers. Use snipe nose pliers to adjust wire nosepads. Many specialists prefer half-round pliers.

Peening pliers. Peening pliers are used to peen or burnish the ends of hinge screws to prevent them from loosening. The concave portion of the pliers tip is placed on the head of the screw, while the cone-shaped tip is pressed against the end of the screw. This distorts the screw tip so that the screw cannot back out. When removing burnished screws, first file the end flush with the hinge with a hand file, and then remove the screw with a flat-tip screwdriver.

Plastic spectacle warmer. This spectacle warmer, in conjunction with ice cream salt, table salt, or glass beads, is used to heat a plastic spectacle frame prior to adjustment.

Flat-tip screwdriver. This screwdriver, with reversible tip, is handy for screw tightening.

Hand file. Several different files can be used—a rough-cut or bastard file for shaping temple butts and a finer-cut file for removing the peened end of a screw.

Frame Fitting and Adjusting Procedures. Since military spectacle frames are made of a thermoplastic material, heat must be used to soften the frame for adjustment. This heat is supplied by the spectacle warmer, often called a sandbox or saltbox. Cold frame adjustments may be quick, but they always set up strains in the plastic that may cause early breakage.

Heat frames carefully in the sandbox, because the high temperatures encountered in the warmer may completely melt the frame. Remember not to put your fingers in the sandbox—they can cook rapidly. To distribute the heat evenly and prevent pits from forming on the plastic surface, move the frame around while heating it. Because repeated heating ages the frame and makes it brittle, heat only that portion of the frame to be bent. Remember to let the frame cool before placing it on the patient.

It is necessary to make various adjustments when you are fitting the spectacles to the patient. The spectacles should be adjusted to make them as comfortable as possible while maintaining the correct alignment for efficient vision. A pair of spectacles may be in perfect visual alignment and still appear crooked on the patient's face because of irregularities of the features. This may be corrected by proper adjustment.

When you are fitting an adjustable pad spectacle, the first step is to shape the guards (the wires that attach the pads to the eyewires) so that the pads will lie evenly and loosely against the sides of the patient's nose. To make this adjustment, place the spectacles on the patient with the temples over the ears. Hold them by the rims with the temples spread as far apart as possible so you don't injure the patient. Place the bridge of the glasses on the patient's nose in the position in which they will be worn, and note any necessary adjustments. Note also whether the temples should be spread, narrowed, or curved to conform with the side of the patient's head. Shape the pads to conform to the patient's nose, making sure that they do not squeeze the nose.

Again, place the spectacles on the patient with the temples over the ears. Turn the patient's head until you have a side view. Notice the position of the pads, the pantoscopic or retrocopic tilt, and the point where the temples fit the tip of the ear. After noting what adjustments are necessary, remove the spectacles and shape the temples to conform to the contours of the patient's head. If the temples bind or touch the sides of the patient's head, file the butt of the temple until you get the proper spread. Round the temple shafts with the thumb and the first two fingers of the hand until they no longer press against the sides of the head.

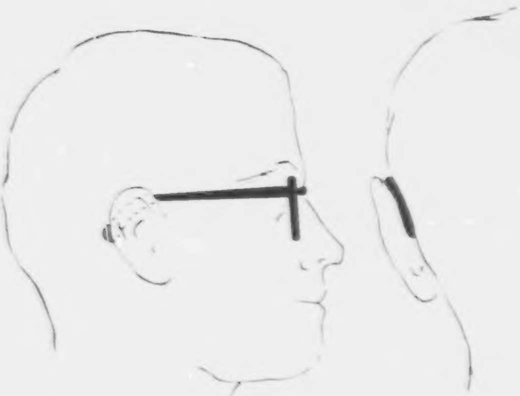


Figure 1-11. Adjustment to skull.

There is a flat space running from the top of the ear, where the temple first touches, to the high spot on the skull, which lies halfway down the back of the ear. This flat part is usually at about a 70° angle. The temple should be shaped to lie flat between these two points. (See fig. 1-11.) The high spot on the back of the ear is extremely sensitive and will become sore with very little pressure. Make a sharp bend in the temple here to distribute the pressure equally between the flat part of the ear and the curve below the high spot. The temple should be curved outward from the depression behind the lobe of the ear because this portion is also sensitive. Although a riding bow temple of the correct length will extend to the center of the lobe of the ear, the tip of the temple should always be shaped so that it will not press or dig into this portion.

Use the following method to shape a temple to conform with the ear. Grasp the shaft of the temple with the left hand to steady it. Place the forefinger of the right hand under the temple at the point where the temple first touches the ear. Place the third finger of the right hand about one-eighth inch down from the forefinger on the lower side of the temple, and place the thumb between the fingers on the upper side. By exerting pressure with the thumb and two fingers of the right hand against the shaft and by holding the shaft steady with the left hand, you can form the bend necessary at the top of the temple and the flat portion at the same time. Next, holding the temple in the same manner, make the temple bend at the high spot of the ear. These bends should make the temple lie evenly along the back of the ear. If the temple does not lie in the proper place, it is necessary to rebend the temple until the proper distribution of pressure is obtained. After both temples have been shaped, replace the spectacles on the patient and note the guard adjustment, the pantoscopic or retroscopic angle, and the parallelism of the lenses to the face, making readjustments if necessary.

If the lenses are too close to the cheeks and too far from the eyebrows, the pantoscopic angle is too great and the temples have to be bent up. When bending temples, you should use two sets of pliers: the endpiece gripping plier to hold the front hinge, and the angling plier to hold the hinge barrels by the screw ends. The temple angle is then changed by bending the metal of the front hinge flange, not by loosening the hinge rivets.

If the bottoms of the eyewires protrude too far from the cheeks, the retroscopic angle is too great and the temples must be bent *down* using the procedure described above.

The next step in adjusting is to note whether or not the spectacles are straight (correctly aligned) on the face. In this alignment, the eyebrows are a poor line to follow because of their width and the fact that they often vary in their height and width on the same individual. The easiest and surest line to follow is the line of the roots of the lower cilia (eyelashes). In adjusting bifocals, mark the top of each segment, and sight these marks with the lower cilia or lower limbus.

In adjusting spectacles to make the lenses lie straight on the face, increase the pantoscopic tilt on the low side or increase the retroscopic tilt on the high side. The bending of one endpiece in a retroscopic or pantoscopic direction does not raise or lower the spectacles as a whole on the face; the nose acts as a fulcrum, and as one side is lowered, the other is raised. Where both endpieces are bent, the effect is to increase the pantoscopic or retroscopic angle as the case may be.

Next, note the position of the lenses in relation to their distance from the eyes, particularly the lashes. For best optical effects, the lenses should rest about 13.5 mm from the cornea. The lenses should never touch the lashes. If the lenses are too far from the eyes, the easiest method of adjustment is to widen the spread of the nosepads or to use a wider bridge. If the lenses touch the lashes, narrow the spread of the nosepads without pinching the nose or use a narrower bridge.

Notice the distance of each lens individually from the eye. If one lens is closer than the other, the templefront angle is wrong. To make the necessary adjustment, increase the angle on the side that is too far from the eye or decrease the angle on the side that is too close to the eye. Which adjustment to make will depend upon the overall head pressure produced by the adjustment. To be sure of equal temple pressure, place the spectacles on the patient and, holding each endpiece by the tip of the first finger, pull the spectacle slightly from the nose and see whether or not they fall back on the nose evenly.

Finally, check to see that the spectacles fit perfectly and that each lens is an equal distance from the nose; if not, adjust accordingly. A summary of fitting and adjusting procedures follows:

(1) Check that the lenses are straight in the rims and that the axes are aligned properly.

(2) Be sure that the pads lie evenly or flat on the side of the nose and that the temples spread so that they will not bind the sides of the patients head.

(3) Be sure that the temples conform to the back of the ear and that the front is bent to the desired pantoscopic or retroscopic tilt.

(4) Note the height or horizontal position of each lens on the face, raising or lowering retroscopic or pantoscopic tilt of the endpiece as necessary.

(5) Note the height of the glasses on the face.

(6) Note the distance of the glasses from the cornea.

(7) Note the distance of each lens from the nose; then make a general checkup of all previous adjustments.

The accompanying table (table 1-4) outlines common frame maladjustments and remedies.

Exercises (405):

1. Name the tool to use for the following actions.

   a. Adjusting wire nosepads.

   b. Crimping hinge screws to prevent loss.

   c. Removing the peened end of a screw.

   d. Rotating cylinder axes.

   e. Bending temples.

2. State the procedure you should follow to readjust frames with the following problems.

   a. Right side rides high.

   b. Both lower eyewires touch cheeks.

   c. Temples too tight.

   d. Pressure behind ears.

   e. Lenses touch lashes.

3. Summarize seven major steps in fitting frames.

TABLE 1-4

COMMON FRAME MALADJUSTMENTS AND REMEDIES

Condition	Cause	Remedy
Pads dig into nose evenly.	Pads too tight.	Widen distance between pads.
	Temple tension too great (too short).	Reduce tension by moving temple bend toward tip.
	Pads too small for weight of glasses.	Larger pads.
	Tender skin.	Toughen skin with alcohol or other means.
Pads dig into nose unevenly.	Pads do not fit flat on nose.	Correct pads to fit flat on nose.
	Temple angle greater on one side.	Correct temple spread.
Spectacles slide down on nose.	Frame bowed at bridge.	Heat bridge and bend so that a PD stick placed across the back of the front touches the eyewires at four points.
	Distance between pads too great.	Bring pads closer together.
	Temple tension too weak or temples too long.	Replace with shorter temples or increase tension.
Lashes touch the lenses.	Distance between pads too great.	Bring pads closer together.
	Temple tension too weak or temples too short.	Replace temples or reduce tension.
	Guard arms too short.	Lengthen guard arm.
Eyewires touch cheek.	Too much distance between pads.	Bring pads closer together.
	Pantoscopic temple angle too great.	Reduce pantoscopic tilt.
	Lenses too large in vertical dimension.	Refit with smaller eye size.
Lenses touch brow.	Inset too far.	Lengthen guard arms.
	Resting point on nose too high.	Lower spectacles by raising guard arms and pads.
	Too much retroscopic tilt.	Reduce retroscopic tilt.
One lens higher than the other.	Temples not adjusted to different ear heights.	Correct temples either retroscopically or pantoscopically.
	One guard arm and pad lower than the other.	Adjust to balance.
	Deformed nose.	Compensate for difference with guard arm and pad.
One lens out further than the other.	Temple angle uneven.	Correct temples in reference to angle.
	One side of patient's face larger than the other.	Widen angle of temple on side of face which is larger.
Temples hurt behind ears.	Tension too great.	Loosen temple tension or get longer temples.
	Uneven pressure.	Bend temples to conform with shape of ear.
	Area of contact too small between temple and ear.	Use temple tubing to increase size of temple surface. (Comfort cable temples only.)
	Temple too short.	Get longer temples.
	Corroded or rough surface.	Replace temple.
	Temples ride too far out on top of ear and cartilage.	Bend tip of temple to correct.
	Temple tip rides too far out at the base of ear.	Bend tip of temple in.
Bifocal segments cause blurred area.	Segments too high.	Adjust to proper height by raising guard arms or tilt lenses more pantoscopically.
	Segments too low.	Adjust to proper height by lowering guard arms or tilt lenses more retroscopically.
Lenses too far from eyes.	Pads improperly fitted.	Spread pads.
	Guard arms too long.	Shorten guard arms.

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406. Sequence given procedures for inserting lenses, and state the procedure for removing lenses.

Inserting and Removing Lenses. Xylonite (or zylonite) is a plastic that has been used for spectacle frames for many years. The possibility of inserting lenses into frames made of zylonite is dependent upon the expansion of this material when heated and its contraction or shrinkage when cooled to normal temperature. Many methods of handling zylonite are in use, but the methods described here are probably the most common.

(1) Heat the rim of the frame. Always do the right lens first. Before heating the rim, note the lens size and the size of the rim; this will indicate the amount of stretching that may be required. (NOTE: The material can be stretched 2 mm larger than the specified size of the frame. However, a complete range of frame sizes should be maintained in stock, and the correct frame should be used for each job if possible.) Then place the rim of the frame in the bead bath, heating it until it becomes fairly soft. Be very careful not to overheat the rim.

(2) Insert the right lens in the rim. Remove the rim from the heater, and quickly insert the lens. Insert the lens from the *front* of frame, starting from the temporal edge and stretching toward the nasal edge. Be sure to fit the bevel of the lens into the groove of the frame progressively. Since the frame is soft, take care to see that the rim fits evenly around the lens—that is, not pulled over toward the front or the back face of the lens, particularly at the temple hinge position.

(3) Insert the left lens, repeating the procedure outlined in (1) and (2) above.

(4) True up the frame. If a good job of inserting has been done, it is seldom necessary to do much truing up with this type of frame. First, use the lensometer to check that the axes of the lenses are aligned and located accurately. Then place the frame on a flat surface, with the temples open. Both temples should rest on the flat surface simultaneously. If not, adjust the temples as described in our discussion of pantoscopic angle.

To reduce the size of a stretched rim, first heat the rim in the heater until it is quite soft. (NOTE: Do not try to reduce the size of a rim to a smaller size than marked on the frame size.) Then plunge the rim into cold water. Remove the rim from the water and stretch to correct size, using the method outlined above.

To remove lenses from the frame, first heat the rim in the bead bath until it is soft. When the rim is soft, push the lens out toward the front, starting from the nasal edge. Allow the frame to cool in air unless the rim is too large (in that case, use water).

Exercises (406):

1. Arrange the following procedures in the correct order by numbering the steps in the given blanks.

a. ____ Adjust temples.
b. ____ Heat the frame rim.
c. ____ Note lens size and rim size.
d. ____ Use the lensometer.
e. ____ Place frame on flat surface with temples open.
f. ____ Insert right lens in the rim at the temporal edge.
g. ____ Stretch lens toward nasal edge.

2. Briefly state the procedure for removing lenses.

407. Algebraically determine the best substitutes for given prescriptions.

Repairs to be Sent to the Lab. Sometimes the glasses are in such bad shape that you cannot repair them in the clinic. If the lenses are still in good condition, you may simply replace the whole frame, but if the lenses are badly scratched or broken, a completely new Rx may be ordered. If it is necessary to send the glasses to the lab for repair (one lens broken or guard arms damaged), it may be necessary to supply the patient with a temporary substitute pair of glasses. A knowledge of spherical equivalents is helpful here. Remember spherical equivalents? To find the power of a sphere that is the best substitute for a spherocylinder lens, take half of the cylinder (cyl) power and algebraically add it to the sphere (sph) power. The result is a substitute spherical lens.

$$\text{Sph equiv} = \text{sph} + 1/2\ \text{cyl}$$

Example: A patient wearing OD −5.00 −1.00 × 180, OS −6.00 − 0.50 × 165, broke their left lens. What spherical lens can be substituted until new glasses arrive?

$$\begin{aligned}\text{Sph equiv} &= \text{sph} + 1/2\ \text{cyl}\\ &= -6.00 + (-0.50 \div 2)\\ &= -6.00 + (-0.25)\\ &= -6.25\ \text{D sph}\end{aligned}$$

When sending a frame to the lab for repair, don't forget to include all necessary data on the DD Form 771, Eyewear Prescription, including the Rx for *both* lenses (in case one is broken at the lab). Check Repair on the form, and state what repairs are to be made in the Comments block.

Exercises (407):

1. In an emergency situation where a patient has broken his or her glasses, what spherical lens would be the best substitute for the following prescriptions?

a. +2.50 +2.50 × 090.

b. −6.50 −1.00 × 180.

c. +5.00 −5.00 × 180.

d. −2.00 +4.00 × 090.

Spectacle Orders

THUS FAR IN THIS CDC, we have followed the steps a patient would take to request an appointment, complete a preliminary vision survey, and be measured and fitted for glasses. This chapter shows you how to complete a spectacle order, what visual effects the new glasses will have on the patient, and how to control your spectacle order program.

2-1. Completion of Spectacle Order Forms

There are three sources from which you can order new glasses for a patient: (1) a current prescription written by a military eye specialist (usually on the eye exam form or on a military prescription blank); (2) a current prescription written by a nonmilitary eye specialist (usually on a prescription form); and (3) the patient's old glasses (which you have neutralized on the lensometer). In all of these cases, your order to the lab for fabrication of any spectacle prescription will be written on either a DD Form 771, Eyewear Prescription, or a DD Form 771–1, Eyewear Prescription, Plastic Lens (or an AE Form 1070, USAREURUSAFE Special Order Spectacle Form, if you are in USAFE).

408. Complete sample entries in a DD Form 771.

The bible for optometry specialists ordering glasses is a triservice regulation, but to us it's still known as AFR 167–3, *Medical Services Ophthalmic Services*. At this stage in your career, you should be extremely familiar with both AFR 167–3, and DD Form 771, but let's review some of the important points.

DD Form 771 and DD Form 771–1. DD Form 771 is used to order eyewear with glass lenses. The lenses may be either single-vision or multifocal, and the processing lab location may be different for these two types of lenses. The locations of the processing labs for your area are given in AFR 167–3, Appendix B.

The DD Form 771–1 is designed for ordering plastic lenses only, but most servicing labs would prefer use of a DD Form 771 with the words "plastic lenses" in the Special Lenses or Frame block. Plastic lenses are available in power of ±5.00 D and over for single-vision lenses, and ±5.00 D and over for multifocal lenses. The Navy does nearly all Rx's in plastic.

Let's look at a DD Form 771 and review the material that is to be included in each block. Refer to foldout 1 (bound in the back of this volume), which shows the form with labels corresponding to the numbers below, and a completed form.

(1) The date the order was written.

(2) A number assigned serially within the fiscal year and the fiscal year; for example, 204-82 means the 204th order during FY 1982 (FY 82 began on 1 Oct 81). This number is also recorded in the spectacle order logbook.

(3) The address of the optical lab, as shown in AFR 167–3.

(4) Your complete address.

(5) Self-explanatory.

(6) Self-explanatory. Include patient's phone number.

(7) and (8) Check the appropriate blocks.

(9) If ordering a female style frame, check "female," circle "female," and enter "S–14 or female" in item (25).

(10) Check the appropriate block. Enter verification in (25). (See AFR 167–3, para 6f.)

(11) Check the appropriate block. Enter repair to be done or type of mask insert in item (25). Do not confuse the M–17 and M–17A1 inserts.

(12) through (15) Self-explanatory.

(16) Enter "1" or "2". Remember that some frames are limited issue; for instance, only one pair of half-eye spectacles is authorized.

(17) The lab will usually send only one case per order, since it is assumed that the patient is wearing one pair of glasses.

(18) Glass single-vision lenses should be ordered in plus cylinder form. Plastic single-vision and multifocal lenses or glass multifocal lenses should be ordered in minus cylinder form. Use multiples of 0.25 D only. To convert cylinder forms, algebraically add the sphere and cylinder and record as new sphere. Change the sign of the cylinder and record as new cylinder. Change axis 90° and enter as new axis.

(19) Compute decentration as explained in Chapter 1 of this volume.

(20) Indicate the amount of prism in prism diopters and the direction of the base.

(21) Indicate reading addition.

(22) through (24) Record these data for the reading addition of a bifocal or trifocal. If you are ordering a trifocal, record the overall height in (22). The trifocal intermediate segment is usually 7 mm high and 50 percent of the reading addition. Compute decentration as described earlier.

(25) Include any special justifications or significant lens or frame characteristics here; example, D–25 Trifocal with 50 percent intermediate.

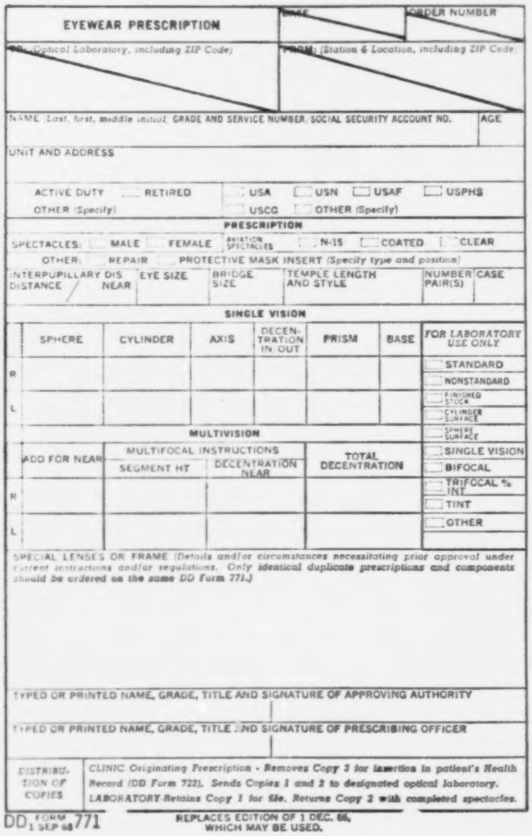
(26) Signature element and signature of senior optometrist if prescription is nonstandard in nature. If there is only one optometrist, he/she will sign in both Approving Authority and Prescribing Officer blocks.

(27) Signature element and signature of optometrist. Don't forget that a DD Form 577, Signature Card, must have been submitted to the labs before anyone is authorized to sign the DD Form 771.

Exercises (408):

Using samples of DD Form 771 and DD Form 771-1 (fig. 2-1 through 2-4), correctly complete the appropriate form for each of the following patients:

1. SSgt Kenneth L. Hall
   316-21-1431
   26th AMS 2614
   +2.00 − 1.00 × 180
   +1.50 − 0.75 × 175
   63/60 46/24/4 1/2 zyl



EYEWEAR PRESCRIPTION | DATE | ORDER NUMBER

TO: (Optical Laboratory, including ZIP Code) | FROM: (Station & Location, including ZIP Code)

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. | AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☐ USAF ☐ USPHS
☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE ☐ AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR
OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

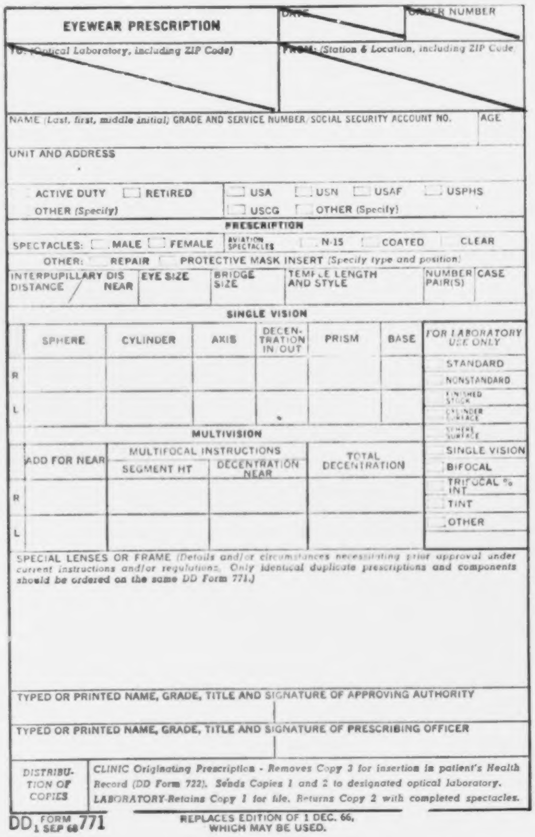
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES | CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2-1. Eyewear prescription (Obj. 408, Ex. 1).

2. TSgt Gregory M. Hainline
   121-81-3918
   12th TFW 4444
   −1.00 − 1.00 × 45
   −1.00 − 1.50 × 135
   Add +1.50 3BOC
   66/62 46/24/4 1/2 zyl



EYEWEAR PRESCRIPTION | DATE | ORDER NUMBER

TO: (Optical Laboratory, including ZIP Code) | FROM: (Station & Location, including ZIP Code)

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. | AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☐ USAF ☐ USPHS
☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE ☐ AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR
OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES | CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2-2. Eyewear prescription (Obj. 408, Ex. 2).

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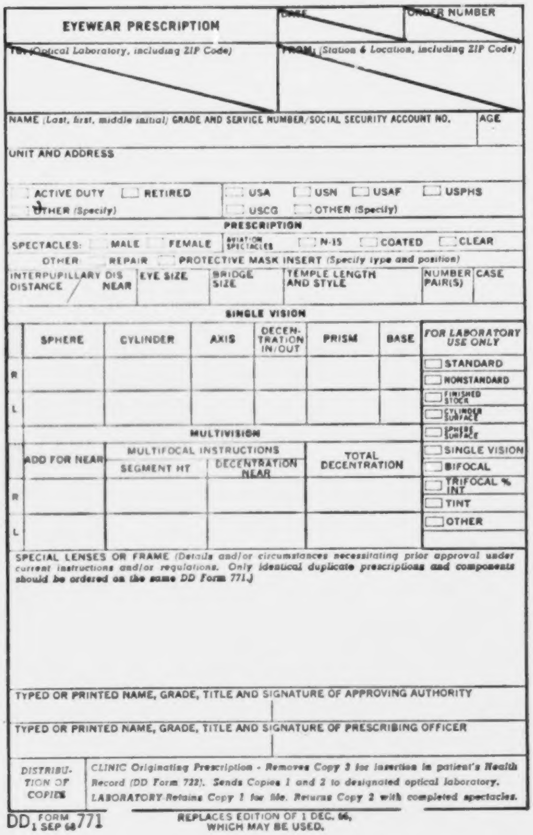
3. Col Donald D. Dunton
512–81–2173
16th AFR 2112
+1.75 − 0.25 × 90
+150 sph
66/62 Half eyes

4. SrA Mary A. Ypma
214–31–1818
36th Supply 2471
−3.00 − 0.50 × 180
−3.50 − 1.50 × 180
64/61 46/20/4 1/4



EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: (Optical Laboratory, including ZIP Code)

FROM: (Station & Location, including ZIP Code)

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE

AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

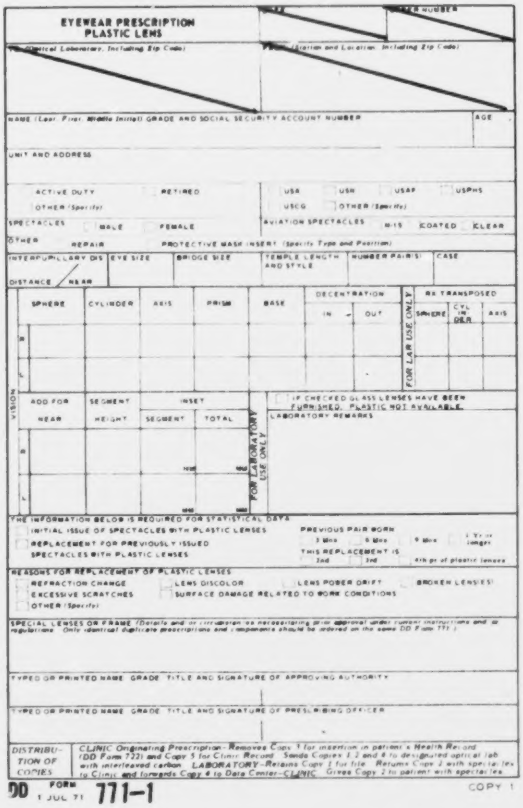
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES: *CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2–3. Eyewear prescription (Obj. 408, Ex. 3).



EYEWEAR PRESCRIPTION
PLASTIC LENS

ORDER NUMBER

TO: (Optical Laboratory, Including Zip Code)

FROM: (Station and Location, Including Zip Code)

NAME (Last, First, Middle Initial) GRADE AND SOCIAL SECURITY ACCOUNT NUMBER

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

SPECTACLES ☐ MALE ☐ FEMALE

AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify Type and Position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

	SPHERE	CYLINDER	AXIS	PRISM	BASE	DECENTRATION		FOR LAB USE ONLY: RX TRANSPOSED		
						IN	OUT	SPHERE	CYL IN DER	AXIS
R										
L										

VISION

	ADD FOR NEAR	SEGMENT HEIGHT	INSET	
			SEGMENT	TOTAL
R				
L				

FOR LABORATORY USE ONLY

☐ IF CHECKED GLASS LENSES HAVE BEEN FURNISHED. PLASTIC NOT AVAILABLE.

LABORATORY REMARKS

THE INFORMATION BELOW IS REQUIRED FOR STATISTICAL DATA
☐ INITIAL ISSUE OF SPECTACLES WITH PLASTIC LENSES
☐ REPLACEMENT FOR PREVIOUSLY ISSUED SPECTACLES WITH PLASTIC LENSES

PREVIOUS PAIR WORN ☐ 3 Mos ☐ 6 Mos ☐ 9 Mos ☐ 1 Yr or longer

THIS REPLACEMENT IS ☐ 2nd ☐ 3rd ☐ 4th pr of plastic lenses

REASONS FOR REPLACEMENT OF PLASTIC LENSES
☐ REFRACTION CHANGE ☐ LENS DISCOLOR ☐ LENS POWER DRIFT ☐ BROKEN LENS(ES)
☐ EXCESSIVE SCRATCHES ☐ SURFACE DAMAGE RELATED TO WORK CONDITIONS
☐ OTHER (Specify)

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES: *CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722) and Copy 5 for Clinic Record. Sends Copies 1, 2 and 4 to designated optical lab with interleaved carbon. LABORATORY - Retains Copy 1 for file. Returns Copy 2 with spectacles to Clinic and forwards Copy 4 to Data Center - CLINIC Gives Copy 2 to patient with spectacles.*

DD FORM 1 JUL 71 771–1

COPY 1

Figure 2–4. Eyewear prescription (Obj. 408, Ex. 4).

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2-2. Interpretation of the Spectacle Prescription

You should now be very familiar with the proper way to fill out a DD Form 771, but can you explain what all those numbers, symbols, and funny words mean to an inquisitive patient?

Many times a patient, like CMSgt Richard Bickley, who has had a civilian Rx duplicated, will ask you questions about the accuracy of his new prescription, because the numbers on his copy of the DD Form 771 don't look the same as the numbers on the civilian Rx blank. You might be able to get away with the statement, "That's the way we order glasses in the Air Force," but an answer such as that usually doesn't satisfy the patient. CMSgt Bickley may convince himself that his military glasses are wrong even though the only difference is in transportation of cylinder forms. To avoid problems of this type, you may wish to use part or all of the following explanations of spectacle prescription elements. The effect of a prescription on *vision* is explained in Chapter 3 of this volume.

409. Counsel patients in hypothetical situations concerning prescription elements.

Spheres. Simple spheres are used to correct simple myopia or hyperopia. The myopic eye is too *strong* (has an excess of plus or converging power) for viewing objects at infinity (its focal length is too short). In order to *weaken* the excessive plus power or in order to lengthen the focal length (which is the same thing), a minus (concave) lens is prescribed. This type of lens diverges light slightly before it enters the excessively convergent eye so that the focal point is moved backwards toward the retina. A hyperopic eye is too weak (has a potential deficiency of plus or converging power) when viewing objects at any distance (its normal focal length is too long). Most people under 40 can compensate for a moderate amount of hyperopia by accommodating (increasing the plus or convergent power of their crystalline lenses), but this means that the muscles that cause accommodation are under a constant stimulus, don't have a chance to relax, and may cause symptoms of eye fatigue. The eye fatigue may be alleviated by increasing the convergence of the light striking the eye with a plus or convergent (convex) lens. Persons over 40 are usually in an early presbyopic stage, which means they are losing the ability to accommodate. They would require the same type of lenses.

Cylinders. Simple cylinders are used to correct simple myopic astigmatism or simple hyperopic astigmatism. Sometimes only a *part* of each eye is myopic or hyperopic, and a cylinder is used to correct that portion of the eye which is myopic or hyperopic. The part of the eye that is most myopic or most hyperopic is labeled a *major meridian* of the eye, and the cylinder must be aligned with the major meridian. Figure 2-5 shows a front view of a left eye with lines corresponding to meridians of the eye. The diagram only shows eight *numbered* meridians, but there are actually 180 meridians, one for each degree of a semicircle (we use 180° instead of 360° because the meridians 180° apart are actually the same; for example, 0° = 180°, 30° = 210°, 45° = 225°, 60° = 240°, 90° = 270°, etc). Note that the numbering begins at the patient's left (your right) and proceeds counterclockwise.

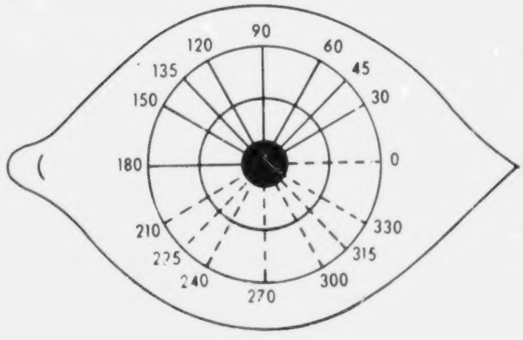

Figure 2-5. Meridians of an eye.

A cylindrical lens also has meridians. The two major meridians of a cylinder are the meridian of most power and the meridian of zero power (see fig. 2-6). The meridian of zero power, termed the *axis* of the cylinder, corresponds to the long axis of the cylinder; and the meridian of maximum power is always 90° away from the axis.

The location of the major meridians of the astigmatic eye is determined by the optometrist during the refraction. In a simple astigmatism, there are two major meridians, one corresponding to the meridian with no refractive error (called the *axis* again) and one corresponding to the meridian with maximum refractive error. These meridians are 90° apart in all astigmatisms, except irregular astigmatism. Part of the examination of an astigmatic patient involves rotating the axis of a correcting cylindrical lens until it corresponds with the axis of the astigmatic eye. When this axis is found, it and the correcting cylinder power are recorded.

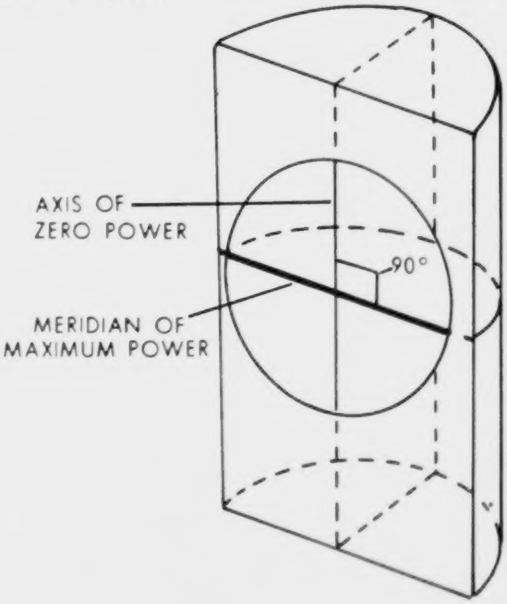

Figure 2-6. Construction of a cylinder lens.

Spherocylinders. Most refractive errors are not corrected by a simple sphere or simple cylinder, they are corrected by a compound lens called a spherocylinder which combines the refractive qualities of simple spheres and simple cylinders. Diagram A in figure 2-7 shows a +2.00 sphere; note that the powers of all meridians are equal. Diagram B in the figure shows the major meridians of the cylindrical lens shown in figure 2-6. Since the axis is the area of zero power, the 90° meridian is labeled "plano" or 0.00 D, and the meridian 90° away (180° meridian) is labeled with the power of the cylinder. (This diagram is called an *optical cross.)*

Diagram C in figure 2-7 shows A and B combined; only the major meridians are shown. Note that a +2.00 sph combined with a pl +1.00 × 90 = +2.00 +1.00 × 90. This last lens is a *spherocylinder*.

Diagram D in figure 2-7 shows a +3.00 D sph. Diagram E is a pl −1.00 × 180 cylinder. The combination is shown in diagram F as +3.00 −1.00 × 180. If you transpose this latter Rx, you will note that the new Rx is +2.00 +1.00 × 90. Thus, diagram C in figure 2-7 is equivalent to diagram F, even though none of the components seem to "match up" to a patient. The difference in plus cylinder and minus cylinder is the placement of the cylinder on the lens. In plus cylinder, it is ground at the lab on the front surface. Minus cylinder is ground on the back surface. A patient wearing a moderate amount of cylinder ground on the back surface may have a small amount of adjusting to do when switching to a military pair ground in plus cylinder. You may wonder why the labs do it differently. The Army has machines to grind front cylinder because it was less expensive and still is, so why change. The civilian labs changed with the times to the more modern machines that grind back surface cylinder.

Prisms. The usual purpose of ophthalmic prisms is to change the apparent position of an object viewed through the prism in order to improve fusion. Diagram A in figure 2-8 shows a patient with right esotropia looking at a white spot of light through anaglyph glasses. Since his right eye is turned nasalward A degrees, the red image is displaced toward the nasal retina A degrees. When this displaced image is projected into space (when the esotrope sees it), he sees the red spot displaced temporarily with his right eye and an undisplaced green spot with his left eye. The result is diplopia.

If a prism is placed in front of the deviating eye with its base out (shown in diagram B in fig. 2-8), the prismatic displacement will cause the red spot to approach the green spot (the image is moved in the direction of the apex). Proper prism power will bring the red and green spots close enough that the patient has the opportunity to fuse the two spots and see one yellow spot. Note that the right eye is still esotropic and still deviated nasally, but the two foveas are now in conjunction with the single spot of light.

Similar effects can be obtained with a base-in prism in front of an exotropic eye, and a base-down prism in front of a hypertropic eye. In all of these examples, the eye remains stable and the image moves.

Slab-Off Prisms. Sometimes a patient has a large amount of anisometropia and experiences induced vertical prism when looking down to read. Figure 2-9 shows an extreme example. In diagram A, a patient wearing OD +4.00, OS −4.00 sph is looking through the optical center (OC) of her glasses. If we ignore the aniseikonic effects,she should have little problem. Now the patient attempts to read, as in diagram B. The optical centers no longer coincide with the lines in sight. If we assume that the patient is reading through her glasses 10 mm below the OC, she will experience 4^{Δ} BUOD and 4^{Δ} BDOS for a total of 8 intolerable prism diopters. Diagram C in figure 2-9 shows how the minus lens would be "slabbed off" to reduce the basedown prism effect while maintaining the same focal length.

Exercises (409):

Answer the following questions as if you were responding to a patient's questions about spectacle prescription elements:

1. Why do the middle numbers of my civilian prescription have minus signs, while the glasses you ordered have plus signs?

2. Little Johnny's prescription has increased from −2.00 to −3.00. Does that mean his eyes are getting weaker?"

3. My doctor told me I have astigmatism. Is that a very bad disease, and what will correct it?

4. My doctor called me a simple hyperope. Was that an insult?

5. The doctor told me that I'm a presbyope, but I'm really a Baptist. What did she mean?

6. Little Susie has crossed eyes, and the doctor said that a prism would make her see better. What did he mean?"

7. The doctor said that since each of my eyes is so different, I would need a slab to read with. What is he talking about?

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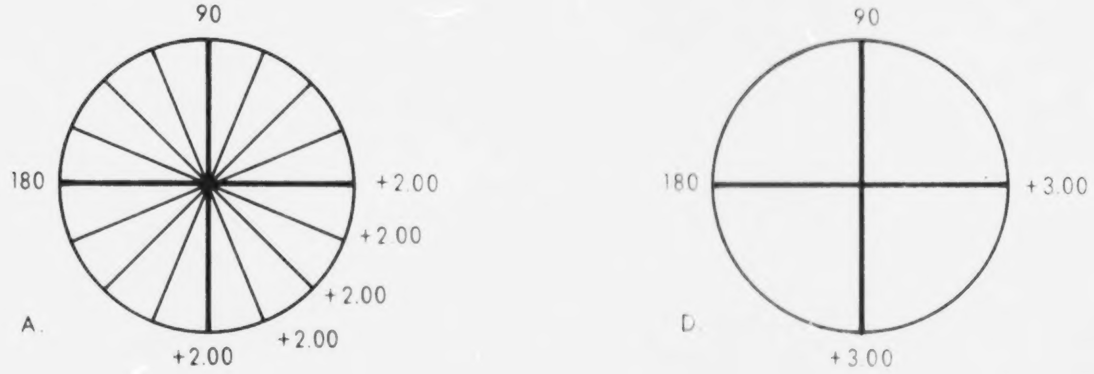
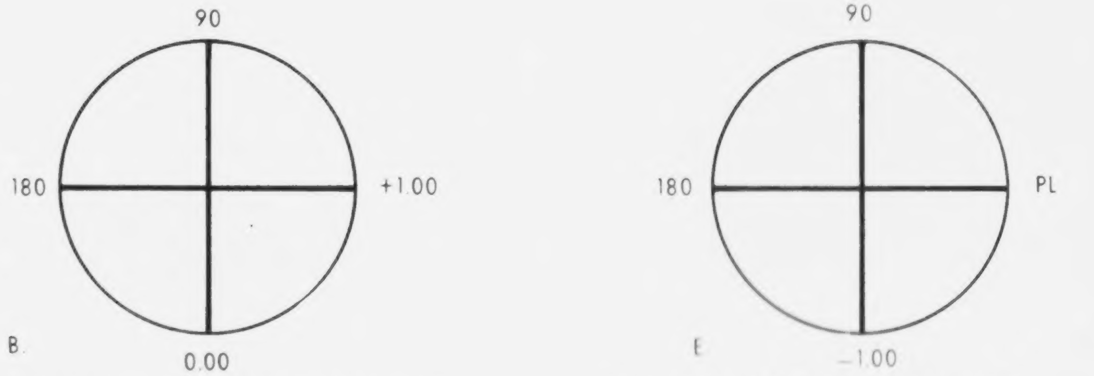

90
180
+2.00
+2.00
+2.00
+2.00
+2.00
A.
90
180
+3.00
+3.00
D.

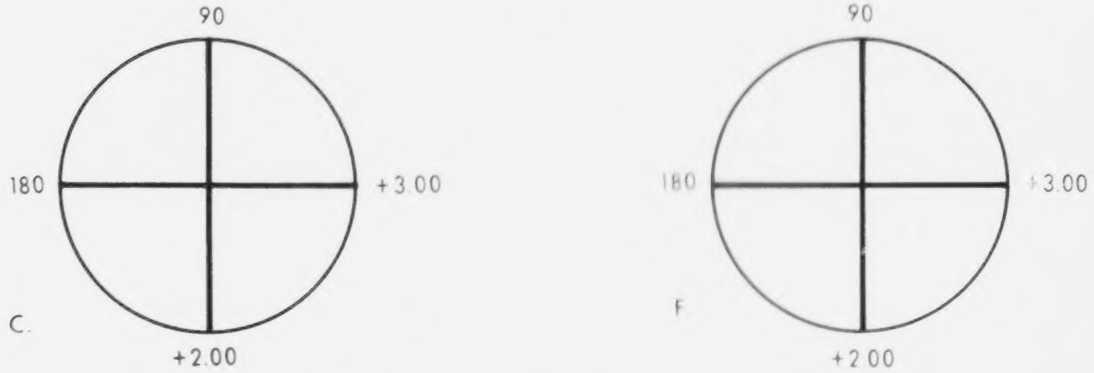
+2.00 SPHERICAL LENS

+3.00 SPHERICAL LENS


90
180
+1.00
0.00
B.
90
180
PL
−1.00
E.

PL + 1.00 × 90 CYLINDRICAL LENS

PL − 1.00 × 180 CYLINDRICAL LENS


90
180
+3.00
+2.00
C.
90
180
+3.00
+2.00
F.

+2.00+1.00×90
SPHEROCYLINDER

+3.00-1.00×180
SPHEROCYLINDER

Figure 2–7. Evolution of an optical cross.

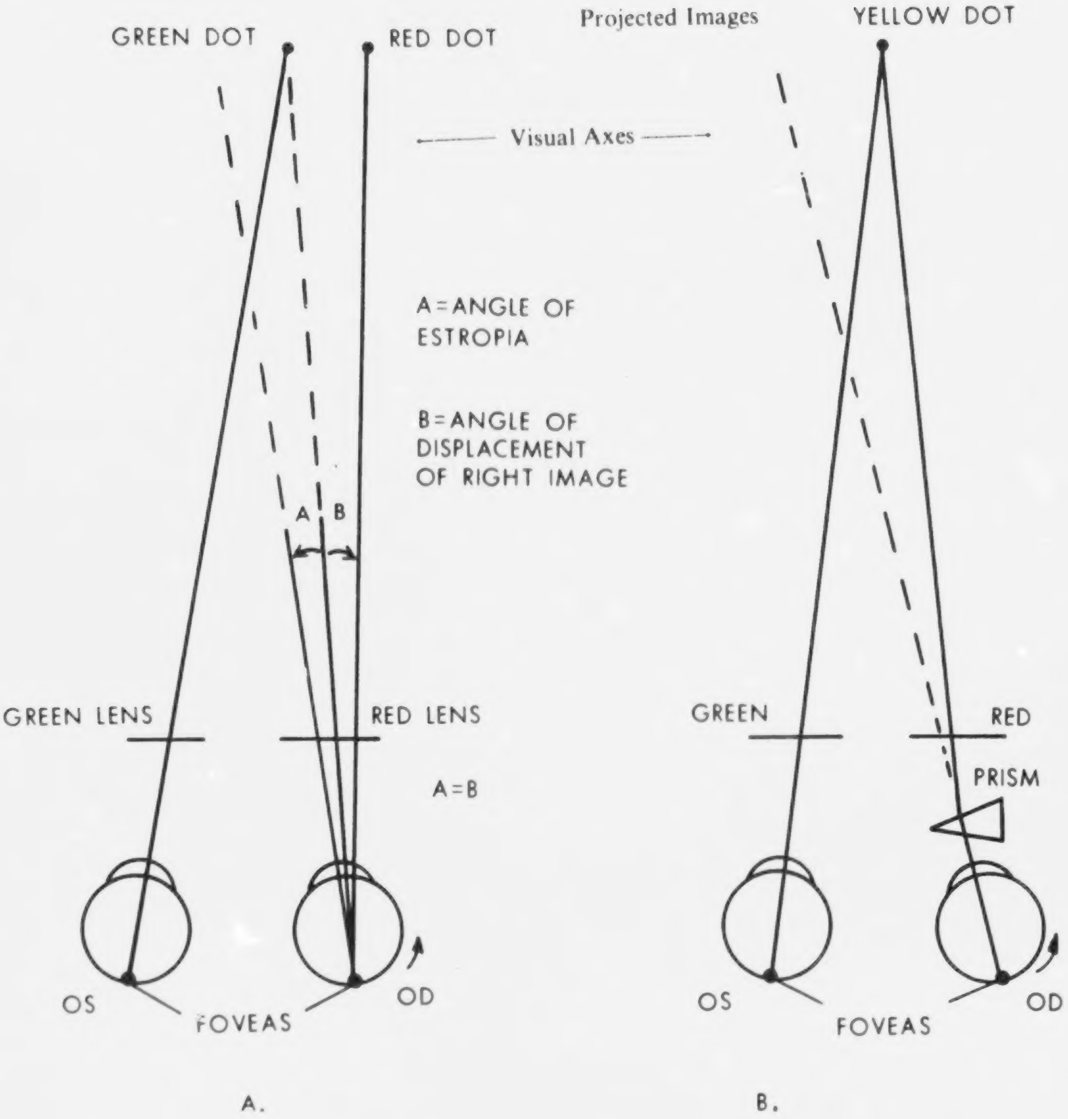

GREEN DOT
RED DOT
Projected Images
YELLOW DOT
Visual Axes
A=ANGLE OF ESTROPIA
B=ANGLE OF DISPLACEMENT OF RIGHT IMAGE
A
B
GREEN LENS
RED LENS
A=B
OS
FOVEAS
OD
A.
GREEN
RED
PRISM
OS
FOVEAS
OD
B.

Figure 2-8. Effect of prisms upon an esotrope.

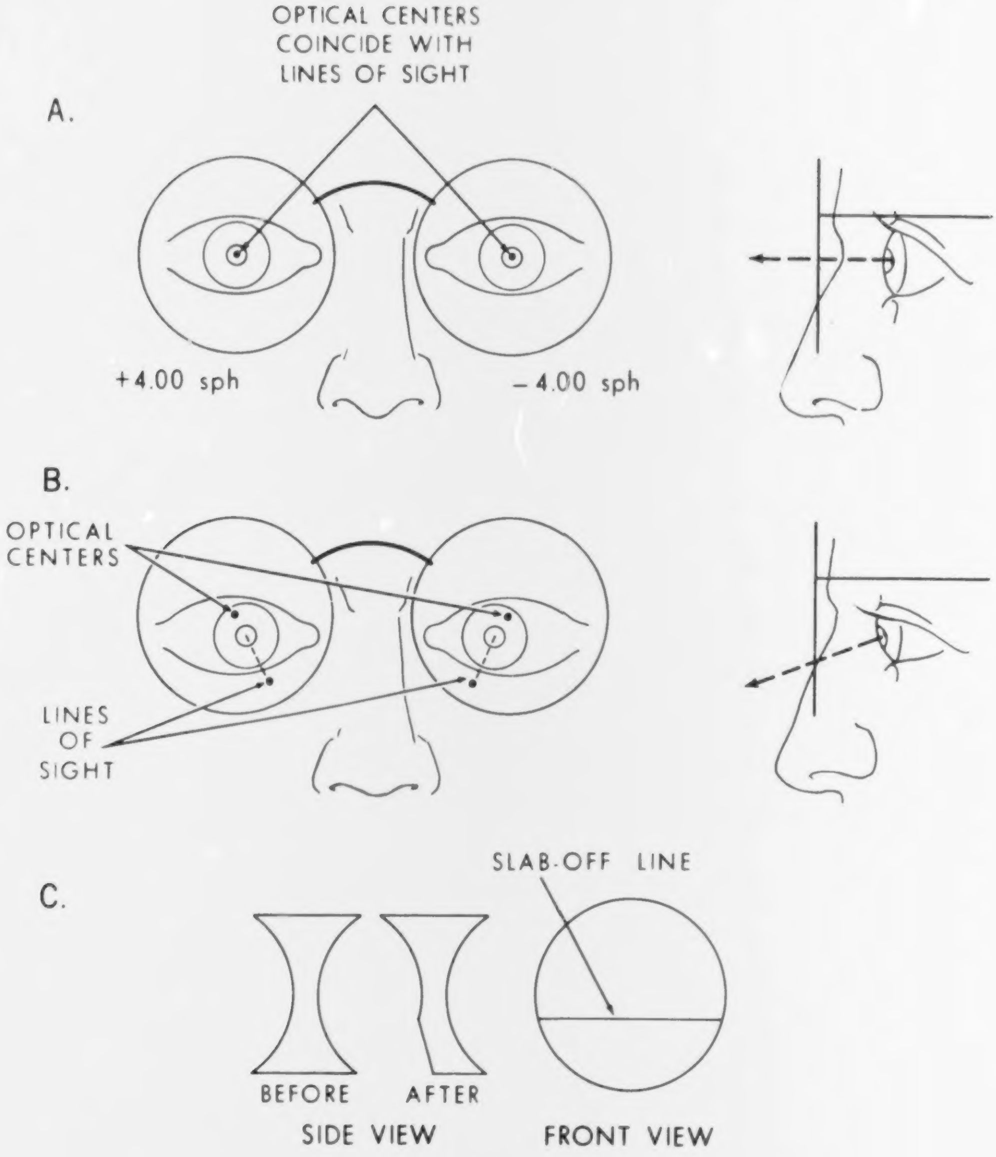

A.
OPTICAL CENTERS COINCIDE WITH LINES OF SIGHT
+4.00 sph
– 4.00 sph
B.
OPTICAL CENTERS
LINES OF SIGHT
C.
SLAB-OFF LINE
BEFORE
AFTER
SIDE VIEW
FRONT VIEW

Figure 2–9. Use of slab-off prism.

2-3. Control and Disposition of Spectacle Orders

Depending upon the workload in your clinic, you may have from 100 to 600 pairs of spectacles on order at any given time. When matters are complicated with spectacles overdue from the lab, delays due to special fabrication requirements, lab and clinic errors, and dozens of patients asking you when their new glasses will be in, then you have a problem on your hands. However, you can solve this problem if you learn the proper way to record, control, and dispense spectacle orders.

410. Cite procedures concerning the disposition of spectacle order forms (DD Form 771) and, given simulated data, record spectacle order transactions in a spectacle order logbook.

Spectacle Orders. Now that you know how to complete a 771 and can explain the Rx to an inquisitive patient, your next step is to send the spectacle order to the lab.

AFR 167-3, *Medical Services Ophthalmic Services,* requires that 771s be mailed to the lab daily. Enter each order in your spectacle order logbook, remove the carbons, staple copies 1 and 2 together at the top center, place them in an envelope (do not fold copies 1 and 2), and mail them to the appropriate optical lab. File copy 3 in a suspense file until the lab returns the completed spectacles.

The lab reviews all spectacle orders to insure compliance with AFR 167-3, returns all erroneous 771s to the originating clinic for correction, and processes correct 771s in the following manner. The editors place copy 1 in a file at the lab and send copy 2 to fabrication or, if the requested Rx is not a stock lens, they send copy 2 to a civilian lab for fabrication. The editors are supposed to notify you when one of your prescriptions is sent to a civilian lab because this action usually involves a delay in processing the order. Eventually, every copy 2 is returned to your clinic with the completed spectacles.

Once the spectacles return from the lab, pull copy 3 from your suspense file, verify the Rx (see Chapter 3), wrap copies 2 and 3 around the spectacles, and notify the patient that the glasses are ready for pickup. When the patient comes for the glasses, give copy 2 to the patient. Put copy 3 in the patient's medical records. You might have the patient sign and date copy 3; that way, if there is ever a question raised as to when or if the glasses were in fact picked up, you would have proof.

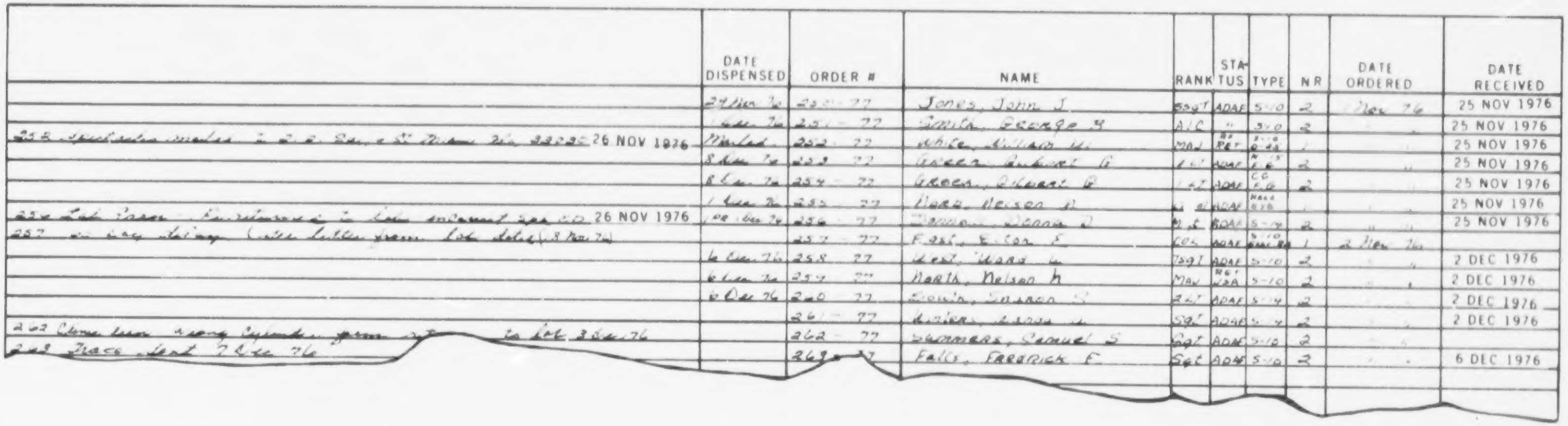
Order Followups. So far we have discussed the route of a typical spectacle order. The DD Form 771 was sent to the lab, the lab filled the prescription and returned it to your clinic, the patient picked up the glasses, copies 2 and 3 were properly disposed of. That transaction is finished; right? That's what one optometry technician thought. Spectacles were ordered for a patient and the patient received the glasses. About a week later, the patient returned to the clinic and wanted to know when the glasses would be ready. The technician checked the suspense file and—no copy 3. Next, the technician checked the spectacles waiting to be picked up—no spectacles for the patient. At this point, the patient became irritated, made a comment about a sloppy system and left the clinic. The technician then pulled out the spectacle order logbook and, lo and behold, the logbook indicated that the spectacles in question had been dispensed the previous week. A quick check of the patient's medical records produced a signed, dated copy of the spectacle order form. The patient had picked up the spectacles! That's not the end of our story. A short time later, the patient returned to the clinic with the hospital commander. Obviously, the patient couldn't deny a signature and date in his own handwriting, and instead of a reprimand from the commander, the technician received an apology from the patient. What would the outcome be if this incident happened in your clinic right now?

The above situation is just one example of the many problems that arise daily in our spectacle order programs. Now, let's investigate some controls that you can establish for you program. Controls won't eliminate problems but they will keep you out of "hot water." In a roundabout way, we have already discussed the major controls; your spectacle order logbook and copies 2 and 3 of the DD Form 771.

Logbook. The purpose of your logbook is to act as a single, consolidated record of the status of all spectacles ordered from your clinic. Your logbook format should be comparable to that shown in figure 2-10. As a minimum, it should contain the spectacle order number; the patient's name, rank, and status; the type and number of pairs of spectacles ordered; the date ordered; the date the completed glasses are received; and the date they are dispensed. In addition, your logbook should show the status of all overdue spectacle orders (on order for more than 45 days), delayed orders due to special fabrication requirements (requested Rx not in stock), and glasses returned to the lab because you or the lab made a mistake. Also, this area is used for patients on flight status who should sign for their glasses.

Suspense Copy. Your suspense file copy (copy 3, DD Form 771) acts as a cross-reference for the information in your logbook. Assume that you have an order overdue from the lab. You should review your suspense file at least once each week, and send a tracer on all orders over 45 days old (order number 257, fig. 2-10, would not require a tracer; the letter should be attached to copy 3 in your suspense file). To complete a tracer you pull all file copies on orders more than 45 days old and fill out a new DD Form 771 for each. Use all the information contained on each original copy 3 except for the date; you should use the date that you initiate the tracer (see fig. 2-10, order number 263-77). Write "Tracer in the special lenses or frame block, remove the carbons, staple the new copies 1 and 2 to the original copy 3 from you suspense file, and send these copies to your optical lab. Finally, annotate your logbook, and file the new tracer copy 3 in your suspense file. Now you have a suspense copy that supports your logbook entry.

You follow essentially the same procedure for spectacles returned to the lab (see fig. 2-10, order numbers 256-77 and 262-77) with the following exceptions. In this case, you have the completed spectacles but must send them back to the lab because you or the lab made a mistake. When you fill out the new 771, write what is wrong with the spectacles in the special lenses or frame block, have your optometrist sign the new 771, and return the original copy 2 (the one



	DATE DISPENSED	ORDER #	NAME	RANK	STATUS	TYPE	NR	DATE ORDERED	DATE RECEIVED
	24 Nov 76	250-77	Jones, John J.	SSgT	ADAF	S-10	2	1 Nov 76	25 NOV 1976
	1 Dec 76	251-77	Smith, George B	A1C	"	S-10	2	" "	25 NOV 1976
252 spectacles mailed [illegible] 26 NOV 1976	Mailed	252-77	White, William W.	MAJ	RET	[illegible]	1	" "	25 NOV 1976
	8 Dec 76	253-77	Green, Robert G	1LT	ADAF	[illegible]	2	" "	25 NOV 1976
	8 Dec 76	254-77	Green, Gilbert B	1LT	ADAF	CG F.G	2	" "	25 NOV 1976
	1 Dec 76	255-77	Ward, Nelson N	[illegible]	ADAF	[illegible]	1	" "	25 NOV 1976
256 Lab [illegible] 26 NOV 1976	10 Dec 76	256-77	[illegible], Donna D	[illegible]	ADAF	S-14	2	" "	25 NOV 1976
257 [illegible] (see letter from lab dated 8 Nov 76)		257-77	East, Elton E	COL	ADAF	S-10 [illegible]	1	2 Nov 76	
	6 Dec 76	258-77	West, Ward W	TSgT	ADAF	S-10	2	" "	2 DEC 1976
	6 Dec 76	259-77	North, Nelson N	MAJ	Ret USA	S-10	2	" "	2 DEC 1976
	6 Dec 76	260-77	[illegible], Samson S	2LT	ADAF	S-14	2	" "	2 DEC 1976
		261-77	Winter, [illegible]	SgT	ADAF	S-14	2	" "	2 DEC 1976
262 [illegible] wrong cylinder [illegible] to lab 3 Dec 76		262-77	Summers, Samuel S	SgT	ADAF	S-10	2	" "	
263 Trace sent 7 Dec 76		263-77	Falls, Frederick F	SgT	ADAF	S-10	2	" "	6 DEC 1976

Figure 2–10. Sample spectacle order logbook format.

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that the lab sent back with the glasses) with the new copies 1 and 2. Staple the new copy 3 to your original copy 3, annotate the logbook, and place them in your suspense file. In this case, you have two 3rd copies on file.

Exercises (410):

1. Which copies of DD Form 771 should you mail to your lab?

2. In what document should you record each order for spectacles? What should this document contain?

3. Where must copies 3 of the DD Forms 771 be filed?

4. How should you dispose of copies 2 of 3?

5. Figure 2-11 is simulated spectacle order logbook. Write each of the following spectacle transactions in the logbook.

DATE RECEIVED	DATE ORDERED	NR	TYPE	STATUS	RANK	NAME	ORDER #	DATE DISPENSED	

Figure 2-11. Logbook (Obj. 410, Ex. 5).

a. Sgt Jones, Jane A. ordered 2 pairs of S–14 spectacles on 21 Jan 82. The spectacles were received on 2 Feb 82 and dispensed 4 Feb 82. The order number is 200–82.

b. Lt Col Stover, James E., USAF (Ret), ordered a pair of S–10, D–25 bifocals on 21 Jan 82. The lab sent you a letter on 30 Jan 82 indicating that the spectacles would be delayed for 45 days because the lenses weren't available. The order number is 201–82.

c. Amn Sheppard, Steven B. ordered 2 pairs of S–10 spectacles on 21 Jan 82. The spectacles were received on 7 Feb 82. While verifying the Rx you discovered that you had transposed the prescription incorrectly. The order number is 202–82.

2-4. Patient Notification Methods

Now that you and the optometrist have spent a considerable amount of time examining the patient and ordering glasses, what is the most convenient way to notify the patient that the glasses have arrived? You may use one of four systems: telephone, mail, Government distribution, or automatic return.

411. Identify the various patient notification methods as to time, expense, and the patient s trouble.

Telephone System. Potentially the fastest notification system is to use the telephone. In this system, one of the clinic personnel collects all of the third copies of the DD Form 771 after checking in the glasses but before filing them alphabetically, and attempts to call each patient. When the patient is notified, the DD Form 771 is marked to indicate the notification and is filed alphabetically.

Some disadvantages in this system are obvious. It's surprising how many people give you the wrong phone number, and how many are out for several days. Leaving a message may be of little help because a high percentage of these messages get lost. In any case, several hours a day may be spent in attempts to phone patients, thus interfering with incoming calls.

Automatic Return System. Some clinicians prefer to tell their patients to call the clinic to check on their glasses 3 or 4 weeks from the date of their exam. The specialist receiving the call simply looks in the alphabetical file of third copies of the DD Form 771 and tells the patient whether or not the glasses have arrived. Unfortunately, some patients call back several times during the first or second week, and others may forget to call back altogether. The frequent phone calls may also interfere with other clinic business.

Mail Notification. The system that has been in use for many years, involves a patient notification card similar to that shown in figure 2-12. Each patient requesting glasses fills in the address side of the card (thereby reducing clinic paperwork time). The cards are filed with copy 3 of the DD Form 771. When the glasses arrive from the lab, the card is mailed to the patient. (Believe it or not, in 1974 one of the Sheppard AFB specialists received a nice cash award for suggesting this system!)

Distribution Notification. Some bases do not like to use official U.S. mail to notify patients, and specialists at those bases may try to use the Government distribution system to get notification to their patients. A card similar to figure 2-12 may be used, except that the address elements is to the patient's organization, and the card is not franked. This system may be a little cheaper than the others, but many patients don't remember their distribution address, and you must address the carrier envelopes.

Exercises (411):

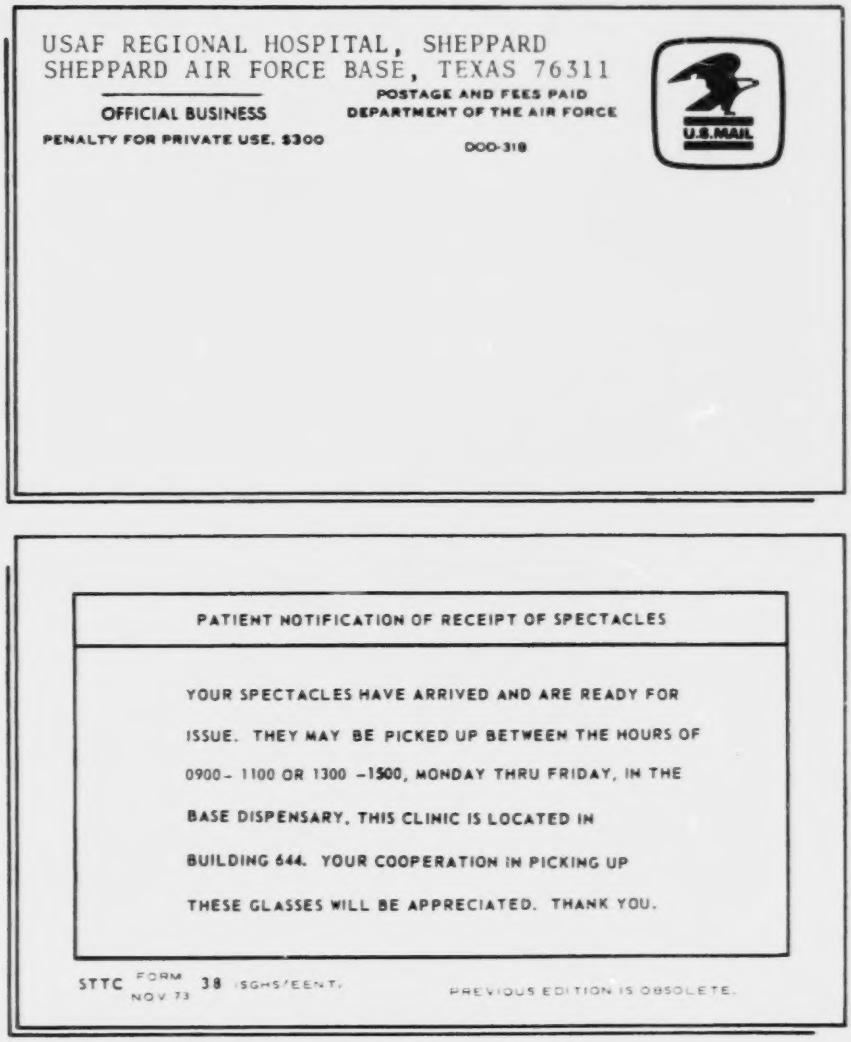
1. Match the item in column A with the appropriate item column B. Use each letter only once.

Column A

_____ (1) Potentially the fastest.
_____ (2) Least expensive.
_____ (3) Least time consuming.
_____ (4) Most trouble for the patient.

Column B

a. Telephone system.
b. Automatic return system.
c. Mail notification.
d. Distribution.



USAF REGIONAL HOSPITAL, SHEPPARD
SHEPPARD AIR FORCE BASE, TEXAS 76311

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE AIR FORCE
DOD-318

PATIENT NOTIFICATION OF RECEIPT OF SPECTACLES

YOUR SPECTACLES HAVE ARRIVED AND ARE READY FOR ISSUE. THEY MAY BE PICKED UP BETWEEN THE HOURS OF 0900- 1100 OR 1300 -1500, MONDAY THRU FRIDAY, IN THE BASE DISPENSARY. THIS CLINIC IS LOCATED IN BUILDING 644. YOUR COOPERATION IN PICKING UP THESE GLASSES WILL BE APPRECIATED. THANK YOU.

STTC FORM NOV 73 38 (SGHS/EENT) PREVIOUS EDITION IS OBSOLETE.

Figure 2-12. Patient notification card.

CHAPTER 3

Spectacle Verification

PERHAPS ONE OF the most boring jobs in the optometry clinic is that of final spectacle verification. Although this phase of your work may seem particularly unrewarding, it is extremely important. It is foolish to spend much time examining and fitting a patient and then to cancel all of the effort by not giving the patient's glasses a final checkout to determine whether or not the spectacles are really what the doctor ordered. The few minutes you must take to verify a pair of glasses is more than compensated for by the elimination of patient complaints caused by erroneous prescriptions.

3-1. Quality Control Standards

In 1956, a committee sponsored by the Optical Society of America drew up a a list of quality control requirements for ophthalmic lenses. This committee was reorganized in 1970, with representatives present from all eye-care fields, including those in the Departments of the Air Force, Army, and Navy. The findings and recommendations of this committee are given in this chapter to familiarize you with the standards you should apply to all ophthalmic lenses.

412. Specify requirements for the quality control of spectacle lenses.

When you read the *American National Standards Recommendation for Prescription Ophthalmic Lenses,* you may become confused. In this chapter, we attempt to clarify the standards. Keep in mind that the book of standards was written primarily for labs. They use very sophisticated instruments. For our purpose, the standards will be adjusted to a workable and tolerable level.

Physical Quality and Appearance. The lenses must look good. Deep scratches, watermarks, improper surface polishing, bubbles, and waves are unacceptable.

Refractive Power. Here's how the standards look to the labs:

• Sphere:	Plano—	6.50; ± 0.13 D
	above	6.50; ± 2%
• Cylinder:	Plano —	2.00; ± 0.13 D
	2.12 —	4.50; ± 0.15 D
	above	4.50; ± 4%

Keep in mind these tolerances are for a lab with extremely sophisticated instruments. Patients have different tolerances themselves. Some would go up the wall if their prescription was off just 0.12 D, where others would not even notice their's being off as much as 0.25 D. In the clinics, we will use these standards:

• Sphere:	Plano—	6.50; ± 0.12 D
	above—	6.50; ± 0.25 D
• Cylinder:	Plano—	4.50; ± 0.12 D
	above—	4.50; ± 0.25 D

The important thing is that you do check each pair of glasses, because the labs quality control does fail sometimes.

Cylinder Axis. This area is just as important and should be checked critically. For persons who need a moderate to severe amount of cylinder power, a little off can make a lot of difference as to how comfortable the prescription is. Here we will use what the labs use, and it goes as follows:

IF cylinder power is . . .	*the axis should be . . .*
0.12 – 0.37D	± 7°
0.50 – 0.75 D	± 5°
0.87 – 1.50 D	± 3°
1.62 and above	± 2°

Refractive Power Addition. Bifocals should be within ± 0.13 D, but let's use the realistic figure of ± 0.12 D. Any bifocal whose power is ± 0.12 D or more in error should be rejected. Also, reject any bifocal in which the optics at the segment junction appear poor.

Prism Power Limitations. Unwanted vertical prism should not exceed $1/3^{\Delta}$ or the difference in optical centers should not be more than 1 mm in high-powered lenses. When you suspect this situation, spot the lenses at their respective optical centers and measure the vertical differences with a PD rule. Unwanted horizontal prism should not exceed a total of $2/3^{\Delta}$. Now when you find out what kind of prism exists, you simply add the amounts together. Another factor to base your decision as to sending the glasses back or not comes with the PD found in the glasses of high-power lenses. When the PD is ± 2.5 mm different from the patients, send it back to the lab with a good explanation, and a reminder to you to annotate your spectacle logbook.

Segment Location. Each bifocal must be within ± 1 mm of the specified location. The two bifocals must appear symmetrical, and unequal decentration (unless ordered) is a cause for rejection. The 2.5 mm rule applies to bifocal optical centers in comparison with patient's PD also.

Thickness. All lenses supplied by military labs must be impact-resistant. Dress safety glass, impact-resistant lenses must be at least 2 mm thick at the optical center (OC) and at least 1 mm thick at the edge. Industrial safety glass lenses must be at least 3 mm thick at their thinnest point. Thickness should be ± 0.1 mm of that specified. Measure with a lens caliper or thickness gauge.

Impact-Resistant Dress Eyewear Lenses. All dress eyewear must withstand an impact test consisting of a 5/8-inch steel ball dropped from 50 inches. You can tell whether or not a lens has been heat treated for impact resistance by using a colmascope to check for a maltese-cross-shaped stress pattern. However, the new chemically treated lenses do not have this pattern, nor do plastic lenses. The retained copies of the DD Form 771 must indicate the treatment of the lenses and whether they are impact-resistant or not. All impact-resistant occupational lenses must meet Z89.1-1979 standards (occupational standards).

Warpage. Surface curves in the principal meridians must be within ± 1.00 D of design specifications. Plastic lenses mounted in metal frames may have greater warpage and still pass. Surface powers should be measured with your Geneva lens clock as you were taught in 3ABAR91235. Once you have determined that a lens or pair of glasses is defective, you can either try to fix them yourself or send them back to the lab.

Base Curves. When you specify the base curve you'd like the lab to use, the end result should be within ± 0.75 D. If the base curve ever gets radically changed on a high prescription patient you'll find out quickly why the lab has to pay attention to your requested base curve. The Rx may come in perfect and everything be just fine, but the patient will still complain; just take out the lens clock and check the base curve and you'll probably find your answer.

Exercises (412):

1. Most ophthalmic lenses fall within a range up to ± 6.50 D. What is the minimum error factor?

2. Cylinder in the ± 0.50 D to ± 0.75 D range must be within what degrees on the axis to be acceptable?

3. What is the maximum error for cylinders greater than ± 1.62 D?

4. What is the maximum acceptable unwanted vertical prism?

5. What is the maximum horizontal prismatic error that we can tolerate?

6. Within how many mm's must the bifocal be located to be accepted?

7. Within what diopters of what you ordered must base curves be to be acceptable?

8. At least how many mm's thick at their thinnest point must industrial safety glasses be?

9. What is the number name of the standard which we use and the date?

3-2. Military Optical Laboratory Tolerance Standards

From past experience, you realize that military optical laboratories may not supply lenses that meet Z80.1 standards fully in all respects. What standards should you use in accepting or rejecting finished spectacles in a clinical situation?

413. Apply modified Z80.1 standards to given clinical situations.

Military Optical Laboratory Tolerances. What tolerances are followed by military optical laboratories and why are they used? Some 91255 specialists think that since glasses are free, the quality of the prescription may be lowered. Other specialists just don't want a hassle with the optical lab. Some specialists just don't bother to check out the glasses because they assume that quality control personnel at the lab have done their job. The optical lab at Denver processes about 2,000 spectacles a day. Some errors are bound to slip through, and if you don't keep the quality control people "on the ball," your clinic will get most of those errors.

Physical quality. Army and Navy optical labs contract for and receive both finished and semifinished, first-quality lens blanks in a wide selection of powers. Sometimes, when edging or surfacing these blanks, the opticians allow substandard work to be sent to the clinics. Edging and surfacing errors most often seen are surface abrasions or rounded or shallow bevels. If the bevel is too shallow to hold the lens in the frame or if the lens surface is obviously marred by the edging chuck, reject the lenses. Also, reject the lenses if you find any waves or bubbles in them.

Refractive power. One of the old 40-series Army regulations stated that Army lab tolerances for power were ± 0.25 D if the requested lens were not available. Now the Army, as represented by its member on the Z80.1 committee, is supposed to meet the Z80.1 standards. You should reject any lens outside of the power limitation set forth in objective 411. This may, at first, cause some problems with either your lab or the patient who is impatient to get the glasses, but the lab personnel will soon "shape up"—after all, they have no choice. Of course, you should not injudiciously reject a lens that is *minimally* in error. If the patient has an overriding need for the glasses,

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you may wish to reorder the exact Rx while the patient continues to wear the minimally erroneous Rx. When the correct Rx arrives, the erroneous Rx may be used as a spare.

Impact-resistant lenses. Clinics have no facilities for checking the resistance to breakage of their lenses. Heat-treated, dress-thickness lenses have a high rate of spontaneous breakage, and any spontaneous breakage should be reported to your lab. Keep a copy of the report for yourself. Industrial safety lenses are authorized for certain personnel, but you cannot order them through our labs. They are ordered by the respective squadron locally. You may notice that you can order plano industrial lens for a patient who only has one eye. If the patient's lens comes in, you ought to check the thickness of it just to be on the safe side; if they believe it's a safety lens, then it should be

Refractive power addition. The Army labs are being taken over by supply-oriented personnel. Sometimes, due to critical stock shortages, they may think a suitable substitute will suffice. It may or may not—this determination should be left up to the prescribing doctor, not solely to the lab. Reject any bifocals ± 0.12 D or more in error.

Cylinder axis. If the lab made an error, heat the frame and rotate the axis. If the axis is more than a few degrees off, reject it! Refer back to objective 411 for axis standards.

Prism power. Consider an Rx that is supposed to be ordered without prism. When you neutralize such a lens, there should not be any deviation of the optical centers from the patient's PD. We know that the lens blanks supplied to military optical labs are small, but if the patient looks good in a particular eye size, the lab can supply the requested eye size without unwanted prism by surfacing a blank. Reject any Rx with a total of $1/3^{\Delta}$ unwanted vertical or more than $2/3^{\Delta}$ unwanted horizontal prism. In your final inspection, make sure that there is no unwanted prism. In case you have forgotten how to compute primastic power, let us review the two methods.

In method 1, follow these steps:

(1) Neutralize each lens, using the lens-marking device to spot to OCs.

(2) Measure the PD of the glasses as marked in step (1) above.

(3) Obtain the patient's PD as recorded on the DD Form 771.

(4) Find the decentration error for each lens by subtracting the smaller PD from the larger. Divide the result by 2. Change each measurement to centimeters by dividing by 10.

(5) Compute the prismatic effect by using the formula:

$\Delta = d \times F$
d = decentration error
F = power of lens in horizontal meridian

Examples 1: Given the following information, let's compute prismatic effect.

OD + 2.00 + 100 × 180
OS + 2.50 + 0.50 × 100
64/60
48/22/4½

Measure 68mm between OCs because of lab error.

Then follow step 4 as shown below:

68 − 64 = 4 mm total decentration error 4 mm ÷ 2 = 2 mm error for each lens 2 mm ÷ 10 = 0.2 cm error for each lens

Now you can complete the formula.

$\Delta = d \times F$
$= 0.2 \times 2.00$ (OD)
$\Delta = 0.4^{\Delta}$ BO (prism base out)
$= 0.2 \times 2.50$ (OS)
$\Delta = 0.5^{\Delta}$ BO
Total $= 0.4^{\Delta}$ BO + 0.5 BO $= 0.9^{\Delta}$ BO, reject.

In other situations the power in the horizontal meridian is the sphere power combined with the actual cylinder power in the horizontal meridian. Cylinder power is always 90° from the axis. The effective prism base corresponds to the thickest part of a lens; that is, the optical center (OC) of a plus lens or the rim of a minus lens.

Example 2: Given the following information, let's compute prismatic effect.

OD − 3.00 − 0.50 × 180
OS − 4.0 − 0.50 × 90
66/62
50/22/4½

Measure 70 mm between OCs because of lab error.

Follow step 4:

70 − 66 = 4 mm total decentration error
4 mm ÷ 2 = 2 mm error for each lens
2 mm ÷ 10 = 0.2 cm error for each lens

Solve the formula:

$\Delta = d \times F$
$= 0.2 \times 3.00$ (OD)
$\Delta = 0.6^{\Delta}$ BI (prism base in)
$= 0.2 \times 4.50$ (OS)(note actual power)
$\Delta = 0.9^{\Delta}$ BI
Total $\Delta = 0.6^{\Delta}$ BI $+ 0.9^{\Delta}$ BI $= 1.5^{\Delta}$ BI, reject.

In both examples just given, the prism power exceeds $2/3^{\Delta}$ and should be rejected.

A second method of computing prismatic power is as follows:

(1) Spot the patient's PD on each lens.

(2) Read the prism power at this spot through the lensometer.

(3) Add the prism of each lens to find the total prism power.

Segment location. Follow Z80.1 standards in this regard also. Patients quickly realize that they look through nonlevel bifocals. Remember to measure bifocal height from the bifocal line to the lower edge of the lens (the apex of the bevel).

Thickness. Sometimes the lab supplies one lens of a pair appreciably thicker than the other. If this thickness difference is due to a power variation, little can be done; however, if the lenses are of similar power and possess a cosmetically unacceptable thickness difference, reject them. If you check industrial safety lenses for someone, check the thickness to make sure it's what the patient ordered. Advise them to the patient returned to their lab if they aren't okay.

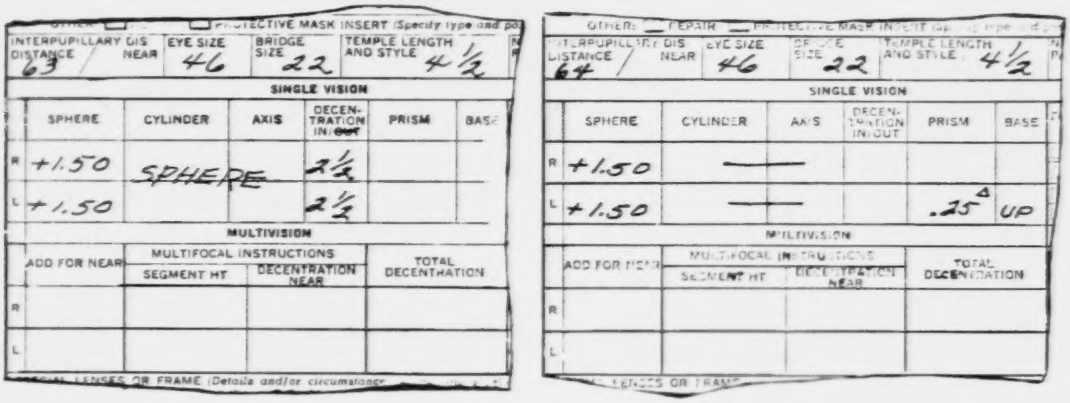
Additional inspection points. Lenses (and frames) should be within ± 0.5 mm of the size you ordered. If you get a substitute size, you may reject it as unacceptable. However, one eyesize larger or smaller for the S–10 frame makes little difference in cosmetic effect for most patients.

Before filing a pair of glasses, make sure that they are reasonably clean and free from glass powder. Peen the screws to prevent the loss of screws and/or temples and possible lens breakage. Set up the frame in preliminary adjustment (take out any warps or unwanted bends), so that you won't be too rushed when the patient arrives to pick up the glasses.

How to Avoid Lab Problems. You have been in the clinic long enough to realize that military medical facilities are based on the premise of "the most good for the most people," or in other words, minimally adequate service for all. Just where do we draw the line between "minimally adequate" and "ethically and professionally poor?" An excellent service takes more time to perform, both in the clinic and in the lab. Just as you may let a few borderline patients slip through because either you don't have time or it's not really that bad anyway, the lab also lets a few off-tolerance spectacles get by, using the same excuse. All of this, in addition to the routine "goofups" that seem to occur in any large organization, may cause the quality of patient care to deteriorate to an unacceptable point, at which time, you, the patient, the O.D., the hospital commander, and the IG all become disturbed. The solution is obvious—stop the problem from developing before the situation deteriorates. Take care of your patients by maintaining a high standard of accuracy in your outgoing work as well as in the quality control measures you impose on incoming glasses. You may see a few less patients, or the waiting time may be a little longer, but nearly everyone that counts (and that includes the patient) will be satisfied. One other thing. It's not against the rules to put a little note in with your orders to the lab letting them know they are doing a good job. Even if the work they send is taking longer or is less than desirable, believe me, it will help that situation tremenodusly. People like a pat on the back and to know that they are appreciated; it makes them work harder because someone noticed their efforts.

Exercises (413):

You ordered glasses as shown in the left-hand sides of figures 3-1 through 3-6. You have now inspected the glasses and found the data as shown in the right-hand sides of figure 3-1 through figure 3-6. For each figure, indicate whether you should accept or reject these lenses according to the clinical tolerances recommended in this CDC. Fore any Rx you reject, state why.



YOU ORDERED THIS:

☐ ☐ PROTECTIVE MASK INSERT (Specify type and

INTERPUPILLARY DISTANCE 63 / NEAR	EYE SIZE 46	BRIDGE SIZE 22	TEMPLE LENGTH AND STYLE 4 1/2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/~~OUT~~	PRISM	BASE
R	+1.50	SPHERE		2 1/2		
L	+1.50			2 1/2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

LENSES OR FRAME (Details and/or circumstance

AND RECEIVED THIS:

OTHER: __ REPAIR __ PROTECTIVE MASK INSERT

INTERPUPILLARY DISTANCE 64 / NEAR	EYE SIZE 46	BRIDGE SIZE 22	TEMPLE LENGTH AND STYLE 4 1/2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	+1.50	—	—			
L	+1.50	—	—		.25Δ	UP

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

LENSES OR FRAME

Would you ___ Accept, or ___ Reject the delivered glasses?

Reason for rejection:

Figure 3–1. Relevant portion of eyewear prescription (Obj. 413, Ex. 1).

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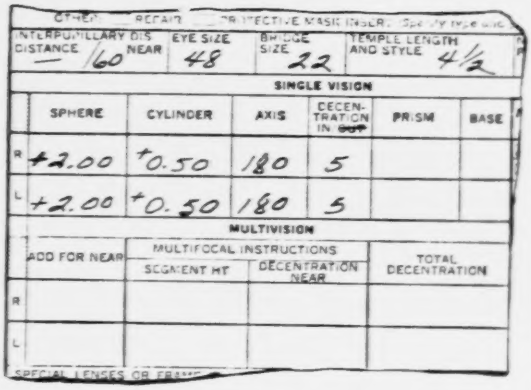
YOU ORDERED THIS:



OTHER: ___ REPAIR ___ PROTECTIVE MASK INSERT (Specify type and

INTERPUPILLARY DIS DISTANCE	NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE
— /60		48	22	4½

SINGLE VISION

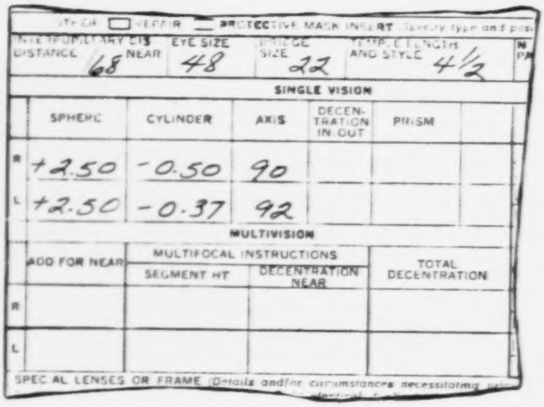
	SPHERE	CYLINDER	AXIS	DECENTRATION IN ~~OUT~~	PRISM	BASE
R	+2.00	+0.50	180	5		
L	+2.00	+0.50	180	5		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

SPECIAL LENSES OR FRAME

AND RECEIVED THIS:



OTHER ☐ REPAIR ___ PROTECTIVE MASK INSERT (Specify type and posi

INTERPUPILLARY DIS DISTANCE	NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE
/68		48	22	4½

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	
R	+2.50	-0.50	90			
L	+2.50	-0.37	92			

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

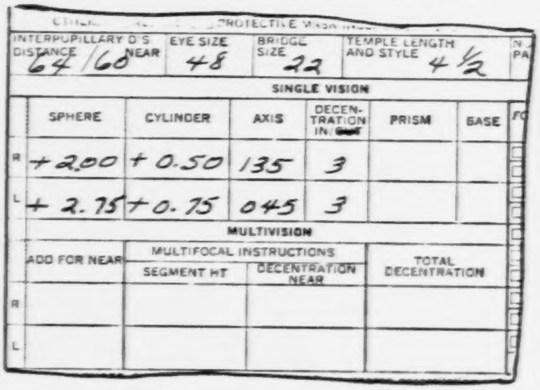
SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating pri

Would you___Accept, or___Reject the delivered glasses?

Reason for rejection:

Figure 3–2. Relevant portion of eyewear prescription (Obj. 413, Ex. 2).

YOU ORDERED THIS:



PROTECTIVE MASK INSERT

INTERPUPILLARY DIS DISTANCE	NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE
64 /60		48	22	4½

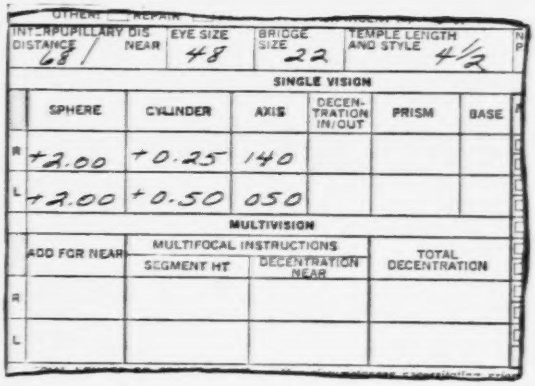
SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/~~OUT~~	PRISM	BASE
R	+2.00	+0.50	135	3		
L	+2.75	+0.75	045	3		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

AND RECEIVED THIS:



OTHER: ___ REPAIR

INTERPUPILLARY DIS DISTANCE	NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE
68 /		48	22	4½

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	+2.00	+0.25	140			
L	+2.00	+0.50	050			

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

Would you___Accept, or___Reject the delivered glasses?

Reason for rejection:

Figure 3–3. Relevant portion of eyewear prescription (Obj. 413, Ex. 3).

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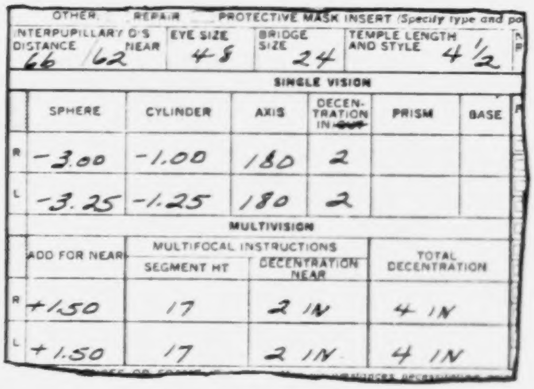

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INTERPUPILLARY DISTANCE / NEAR 66 / 62	EYE SIZE 48	BRIDGE SIZE 24	TEMPLE LENGTH AND STYLE 4 1/2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN ~~OUT~~	PRISM	BASE
R	-3.00	-1.00	180	2		
L	-3.25	-1.25	180	2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+1.50	17	2 IN	4 IN
L	+1.50	17	2 IN	4 IN

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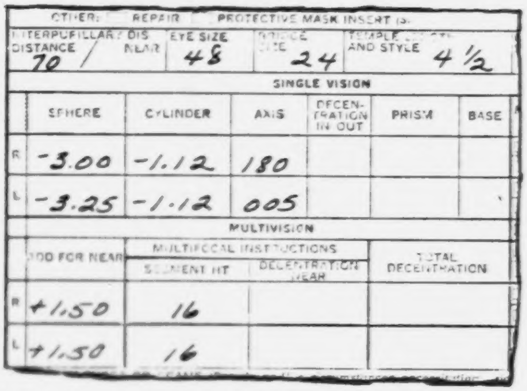

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INTERPUPILLARY DISTANCE / NEAR 70 /	EYE SIZE 48	BRIDGE SIZE 24	TEMPLE LENGTH AND STYLE 4 1/2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN OUT	PRISM	BASE
R	-3.00	-1.12	180			
L	-3.25	-1.12	005			

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+1.50	16		
L	+1.50	16		

Would you ___ Accept, or ___ Reject the delivered glasses?

Reason for rejection:

Figure 3–4. Relevant portion of eyewear prescription (Obj. 413, Ex. 4).

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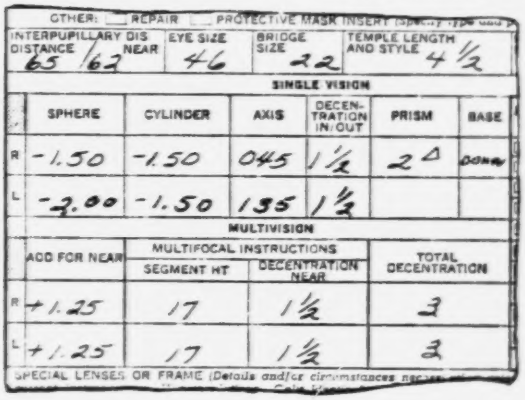

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INTERPUPILLARY DISTANCE / NEAR 65 / 62	EYE SIZE 46	BRIDGE SIZE 22	TEMPLE LENGTH AND STYLE 4 1/2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	-1.50	-1.50	045	1 1/2	2^{Δ}	DOWN
L	-2.00	-1.50	135	1 1/2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+1.25	17	1 1/2	3
L	+1.25	17	1 1/2	3

SPECIAL LENSES OR FRAME (Details and/or circumstances

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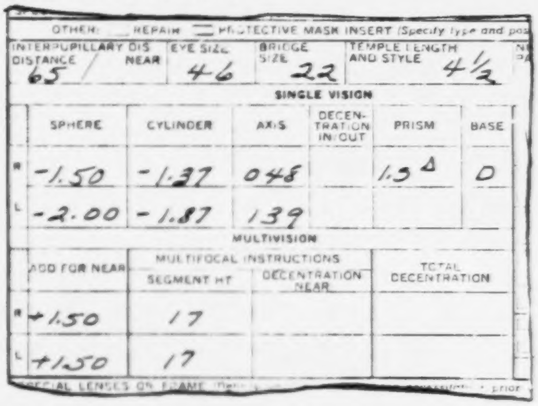

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INTERPUPILLARY DISTANCE / NEAR 65 /	EYE SIZE 46	BRIDGE SIZE 22	TEMPLE LENGTH AND STYLE 4 1/2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	-1.50	-1.37	048		1.5^{Δ}	D
L	-2.00	-1.87	139			

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+1.50	17		
L	+1.50	17		

SPECIAL LENSES OR FRAME

Would you ___ Accept, or ___ Reject the delivered glasses?

Reason for rejection:

Figure 3–5. Relevant portion of eyewear prescription (Obj. 413, Ex. 5).

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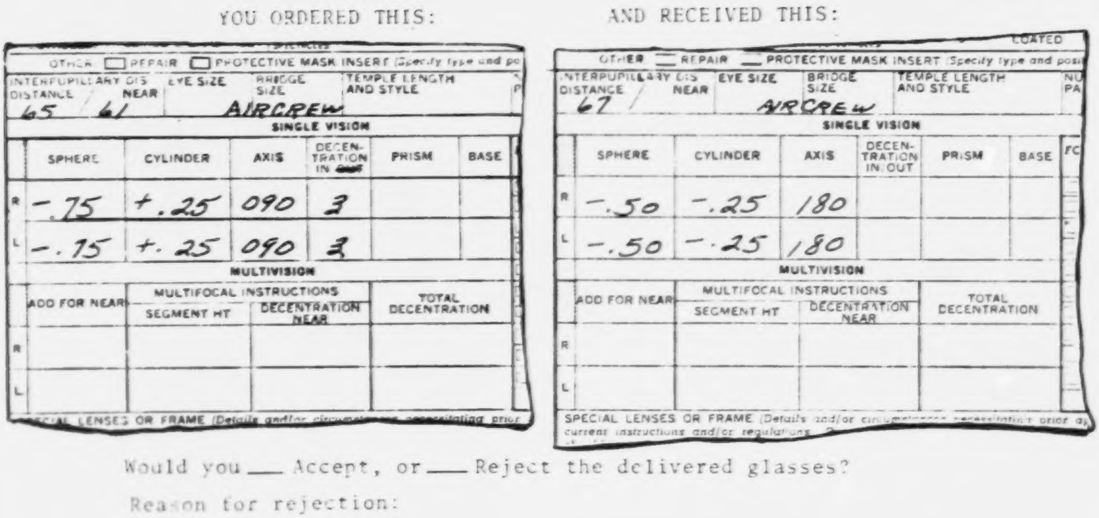

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INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE
65 / 61	AIRCREW		

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN	PRISM	BASE
R	-.75	+.25	090	3		
L	-.75	+.25	090	3		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

LENSES OR FRAME (Details and/or circumstances necessitating prior

AND RECEIVED THIS:

COATED

OTHER __ REPAIR __ PROTECTIVE MASK INSERT (Specify type and posi

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NU PA
67 /	AIRCREW			

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FC
R	-.50	-.25	180				
L	-.50	-.25	180				

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior ap
current instructions and/or regulations

Would you ___ Accept, or ___ Reject the delivered glasses?

Reason for rejection:

Figure 3–6. Relevant portion of eyewear prescription (Obj. 413, Ex. 6).

3-3. Use of the Lensometer

As you know, the lensometer is your most important lens verification instrument. Your daily use of this instrument, in itself, should have brought you to the 5 skill level. This section is intended to give you a few tips about the care and feeding of your lensometer.

414. State the characteristic principles of the lensometer.

Principles of the Lensometer. Have you ever wondered how your lensometer works? Have you ever been tempted to remove the access panels and see what goes on inside it?

Basically, a lensometer (shown in fig. 3-7) consists of a movable illuminated target, a fixed standard lens, a lens holder situated at the secondary focal plane of the standard lens, and a telescope focused at infinity (see fig. 3-8). If there is no lens in the lens holder, parallel rays of light can be made to strike the telescope by moving the target to the primary focus of the standard lens—that is, if the standard lens is +8.00 D, parallel light will leave it when the light source is 12.5 cm from the lens. If we now mark the position of the target, we have a reference point for a plano power lens. If a +5.00 lens is placed in the lens holder, the target must be moved closer to the standard lens in order to maintain parallel rays at the telescope. (Moving the target close to the standard lens increases the negative vergence of the wavefront and effectively cancels the positive vergence induced by the +5.00 lens.) We can mark the new position of the target as +5.00. Similiarly, we can find the equivalent position of the target for every known lens. If an unknown lens is used, the position of the target will then indicate the lens power.

Your lensometer works on the same principle as figure 3-8. Instead of being on a truck, your target is moved on a brass rail by means of the lensometer power wheel, and the wheel is calibrated in diopters. Sometimes an accident may cause the target to remain out of focus even when no lens is in the holder, the reticle is clear, and the power wheel reads zero. If this happens to your lensometer, loosen the setscrews on the power wheel shaft and realign the power wheel, so that the reticle and the target are both clear when the power wheel reads zero. Attempt this procedure only after you have determined that the focusing knob on the telescope eyepiece is not at fault.

Exercises (414):

1. In order for the power wheel to read correctly, how must the light ray leave the lens being tested?

2. How will moving a light source closer to a standard lens affect the refracted wavefront?

3. Looking at figure 3-8, if there isn't a lens in the lens holder, what will the light entering the telescope section of the lensometer do if you turn the power wheel to minus?

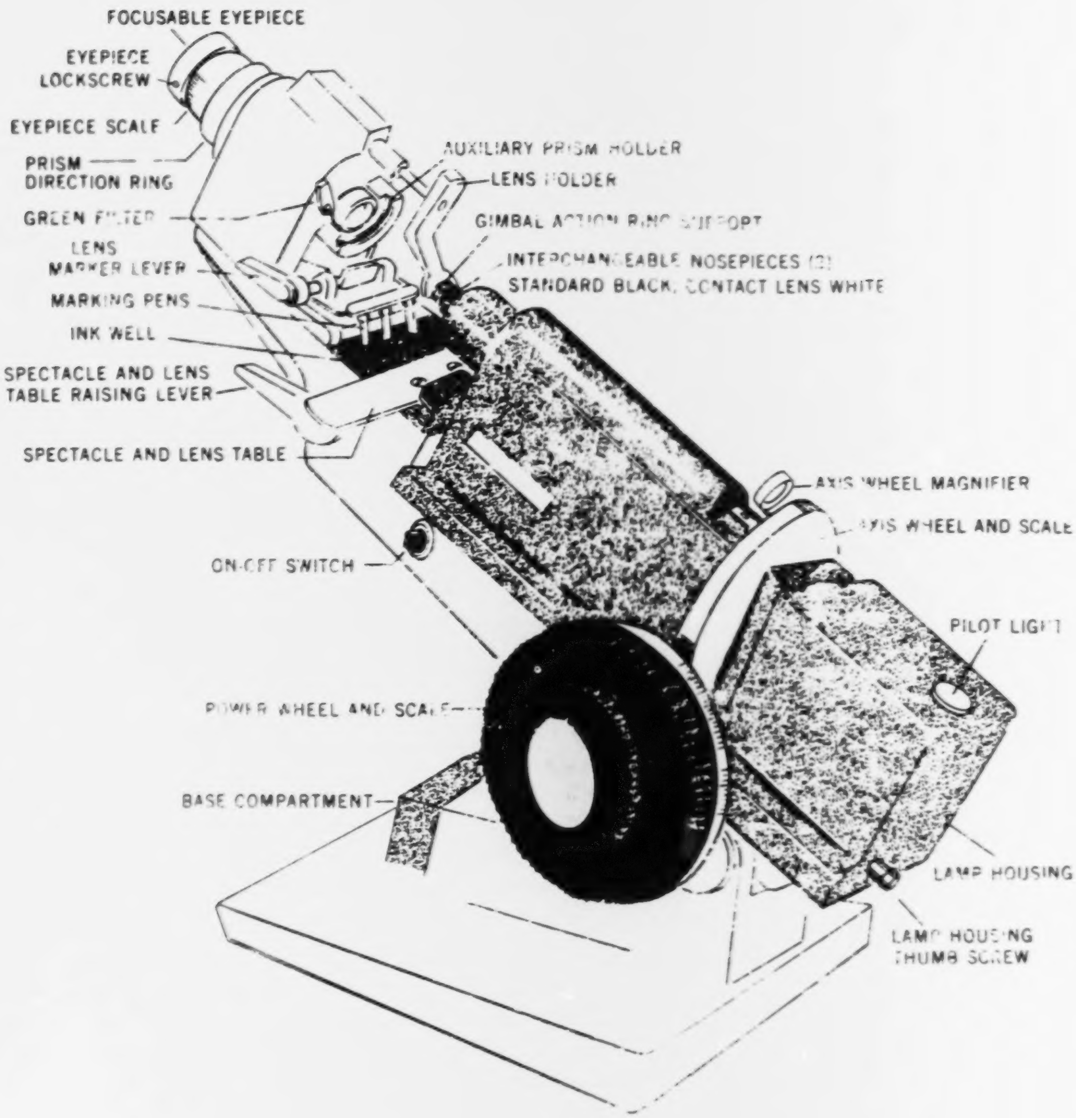
FOCUSABLE EYEPIECE
EYEPIECE LOCKSCREW
EYEPIECE SCALE
PRISM DIRECTION RING
GREEN FILTER
LENS MARKER LEVER
MARKING PENS
INK WELL
SPECTACLE AND LENS TABLE RAISING LEVER
SPECTACLE AND LENS TABLE
AUXILIARY PRISM HOLDER
LENS HOLDER
GIMBAL ACTION RING SUPPORT
INTERCHANGEABLE NOSEPIECES (2)
STANDARD BLACK, CONTACT LENS WHITE
AXIS WHEEL MAGNIFIER
AXIS WHEEL AND SCALE
ON-OFF SWITCH
PILOT LIGHT
POWER WHEEL AND SCALE
BASE COMPARTMENT
LAMP HOUSING
LAMP HOUSING THUMB SCREW

Figure 3–7. The lensometer.

415. State procedures necessary to neutralize a lens with a lensometer.

Lensometer Procedures. The American National Standards Institute recommendation on lensometer procedure may be interpreted as follows (refer again to fig. 3-7 for component names, if necessary):

(1) First focus the eyepiece. Place a piece of white paper in front of the nosepiece. Turn the focusing ring on the eyepiece fully counterclockwise. Look through the eyepiece and rotate it clockwise until the $^{\Delta}$ reticle ring is in focus. Do not rock the eyepiece back and forth. Check your calibration by removing the paper and rotating the power drum while you look through the eyepiece. All target mires should be sharp and clear when the power drum indicates 0.00 D.

(2) When you neutralize a spherical lens, crank the power wheel towards you til it reads +9.00 D. Crank it back towards zero or until all the mires come into focus. They will, all at the same time. Do not rock the focus back and forth; doing so would stimulate accommodation and cause erroneous readings.

(3) Keep the mires centered on the reticle. If the mires are substantially away from the center of the reticle, use prisms to center them (this applies to power measurements only; prism measurement is normally done without auxiliary prisms).

(4) Keep the lens surface in contact with the lens stop. Do not tilt the lens.

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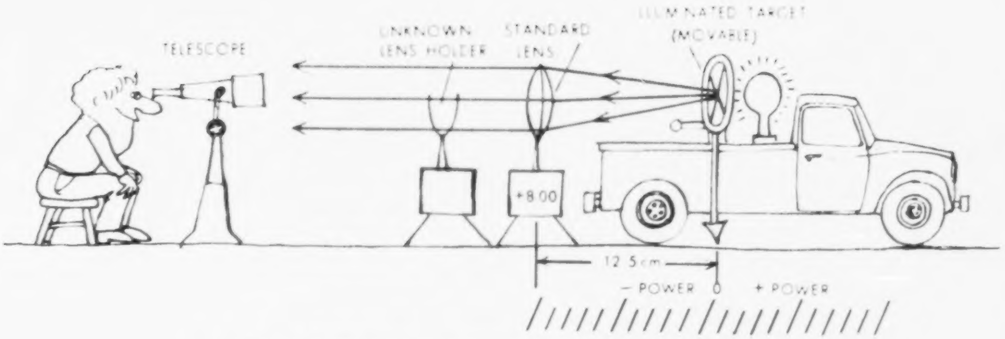

Figure 3–8. Diagrammatic representation of the lensometer optical system.

(5) If you have doubts about the lens power, take five readings and average them.

NOTE: *Single-vision* lens power should be measured with the concave or ocular side of the lens toward the lensometer light source; *bifocal* add power should be measured with the segment side of the lens toward the light source.

The ANSI committee recommends the following procedure for measuring the power of a bifocal:

(1) Place the lens in the instrument with the *segment surface* against the nosepiece. (This means that the *convex* side of the lens will touch the nosepiece for bifocals, such as the D–25 or for one-piece bifocals, such as the Executive.)

(2) Measure the power through the bifocal, focusing on the *vertical* lines of the target image. (Do *not* align the instrument for lens axis; set the fine lines vertically and the fat lines horizontally.)

(3) Move the lens downward so that you are looking through the distance portion of the lens at a point *above the optical* center (OC). This point should be as far *above* the distance optical center as your bifocal measurement point was *below* the OC.

(4) The true reading addition is the difference between the distance and reading portions as measured in steps (2) and (3).

(5) Due to prism power, the target may blur when you are looking through the bifocal. To eliminate this problem, place a prism in the prism holder to center the target image.

To measure vertical prism power, we recommend neutralizing the stronger lens first and then moving the glasses on the lensometer lens table without adjusting the table in order to measure the weaker lens. The new position of the mires in the lensometer will indicate the prism power and base direction. (NOTE: When measuring prism power, remember to focus the lensometer through the glasses at the points on each lens that correspond to the points through which the patient normally looks. These points should correspond to the optical center of the lens but may not.)

Let us now summarize the approved method of lensometer operation, using a properly calibrated lensometer.

(1) Turn the instrument on. This helps to keep the mires illuminated. (If supply is out of replacement bulbs, try a white Christmas tree bulb as an emergency replacement.)

(2) Pull back the lens holder.

(3) Place the spectacles on the lens table with their concave surfaces pointing away from you.

(4) Move the glasses so that the right spectacle lens is centered in front of the nosepiece.

(5) Release the lens holder.

(6) Look through the eyepiece, and center the mires in the middle of the reticle.

(7) Neutralize the lens.

(8) Spot the lens, using the lens marker.

(9) If the spectacles have a bifocal, neutralize it. If the concave side of the lens is left against the nosepiece, the bifocal reading may be slightly in error. Use exactly the same method described earlier if there is some doubt.

(10) Change to the left lens.

(11) Check for vertical prism. If no vertical prism exists, go on to the next step. But if vertical prism does exist, you must neutralize the lens with the stronger vertical power first and then the weaker, reading the vertical prism directly from the instrument.

(12) Check for large amounts of horizontal prism. Horizontal prism may cause the mires to remain decentered, regardless of lens position. The mires are always decentered in the direction of the base. If this is the case, use an auxiliary prism to center the mires. The power of the spectacle prism will then be either the decentered position of the mires or the power of the auxiliary prism used to center the mires (the values should be equal). Horizontal or vertical prism may be present in either or both lenses.

(13) Spot the left lens.

(14) Neutralize the left bifocal.

(15) Measure the distance between lens spots.

(16) Compute or measure the prism induced at the patient's viewing area (line of sight) as we explained earlier.

Effective Power. The lensometer measures *vertex power* of a lens (that is, the power of the refracted wavefront a specified distance from the lens). Sometimes a patient does not wear glasses at the same distance at which the glasses were refracted. For example, a patient's contact lenses are closer to the cones than spectacles, or gas mask lenses may be further from the cones than spectacles. This difference in distance may affect the effective power of the wavefront striking the eye. For example, a patient wearing +10.00 D spectacles would need contact lenses of about +11.00 D or gas mask lenses of about +8.25 D. A myope wearing −10.00 D spectacles would need approximately −8.50 D contact lenses and −10.75 D gas mask lenses. The important thing for you to remember here is that a plus lens held farther from the eye acts stronger than it did in the original position, and a minus lens held farther from the eye acts weaker.

Exercises (415):

1. What is the first procedure in lensometry?

2. When focusing, what will rocking the power wheel back and forth cause?

3. Most lenses are neutralized with which side toward the operator?

4. The most accurate way of measuring issue bifocals is to place which side against the nosepiece?

5. How does the true reading (bifocal) power relate to the far power reading and the near power reading?

6. When measuring for vertical prism power, when do you measure the lens with the weakest power in the vertical meridian?

7. Considering power, is a minus contact lens weaker or stronger than an equivalent spectacle lens?

8. Would a plus gas mask Rx be weaker or stronger in power to its equivalent spectacle Rx?

3-4. Use of the Lens Clock

Sometimes a patient returns with complaint about duplicated prescription glasses and you are unable to find the cause. You've checked power and axis, and they correspond to the old glasses. You ve checked optical center position, and it matches the old Rx. Your next step should be to measure the surface curves of the lens with a lens clock.

416. Relate the aberrations of various ophthalmic lens to their surface curves and characteristics.

Aberrations. Although two lenses may have the same vertex powers, their surface curves (or forms) may differ. Look at the idealized lenses in figure 3-9. The vertex power of all three lenses is the same, +3.00 D. However, the surface curves vary greatly in each case. What happens to the image quality when the surface curves are changed?

All lenses are subject to certain defects that cause their focus to deviate from the theoretical point. These defects, or aberrations, are:

a. Chromatic aberration.
b. Spherical aberration.
c. Coma.
d. Radial astigmatism.
e. Curvature of field.
f. Distortion.

The *chromatic aberration* of a lens causes different wavelengths of light to focus at different distances from the lens. Red light focuses farthest from the lens, while blue light focuses closest to the lens. (See fig. 3-10.) The chromatic aberration of the human eye is the basis for the duochrome test, which was discussed in Volume 2 of this course. Chromatic aberration cannot be corrected in a single lens—a system called an *achromatic doublet* must be used. Lenses display chromatic aberration for the same reason that prisms break up light into a spectrum: both *disperse* white light into its component colors.

The defect known as *spherical aberration* results when light that strikes the periphery of a lens focuses closer to the lens than does light that passes through its central portion. (See fig. 3-11.) Since the pupil of the eye limits the size of the bundle of light rays striking the retina, spherical abberation is not too important in ophthalmic lenses.

Coma is an aberration that results in light focusing at different lateral points, depending upon the point of incidence on the lens. The aberration is limited by the pupil and is insignificant in ophthalmic lenses.

Radial (marginal) astigmatism is the aberration caused by light striking the lens at an angle and behaving as if it were passing through a variable cylinder, even though the lens may be spherical. Radial aberration is extremely important in ophthalmic lenses, since it causes blurry vision when a patient is looking through the periphery of a lens.

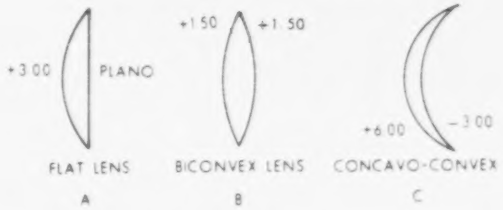

Figure 3–9. Lens forms.

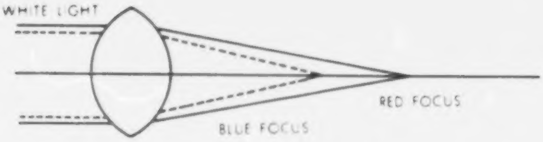

Figure 3-10. Chromatic aberration.

Another very important aberration is *curvature of field*. This defect causes the image of a plane surface to assume the shape of a curved (concave) surface, with the periphery of the image lying close to the lens. (See fig. 3-12).

Distortion is the name of a specific aberration that causes straight lines to appear curved, as in figure 3-13. Minus lenses cause barrel-shaped distortion of square objects, and plus lenses cause pincushion distortion.

The two most important aberrations are marginal astigmatism and curvature of field. Both of these aberrations are dependent upon (1) the surface curves (or form) of the ophthalmic lens under consideration and (2) the size of the finished lens. Biconvex or biconcave lenses have the worst aberrations, while corrected curve lenses (positive meniscus or negative meniscus) have the least. Since the surface curves of a particular power lens may vary according to different manufacturers, patients may notice adaptive problems due to different amounts of marginal astigmatism and curvature of field, especially in high-power or large lenses.

Base Curves. When you are reordering a high-power lens, it is a good idea to order the same *base curve* as on the old Rx. The base curve for plus spherical lenses is on the concave side of the lens. The base curve for spherocylinders is the weaker curve on the cylindrical side. The base curve for military bifocals is the spherical curve on the front surface.

Measuring the base curve of a lens with a lens clock (fig. 3-14) measure is relatively simple if you follow these steps:

(1) Check the accuracy of the measure by placing the three points on a flat piece of glass. The pointer should indicate zero. If it does not indicate zero, gently file away a tiny portion of one outside point if the needle indicates plus (+). Do the same thing with the center point if the needle indicates minus (−).

(2) Place the measuring pointer on the side of the lens containing the base curve. Make sure that the gauge is perpendicular to the lens.

(3) If the lens surface is spherocylindrical, rotate the gauge until the pointer indicates a minimum plus (+) or minus (−) reading. This is the base curve of the lens in diopters.

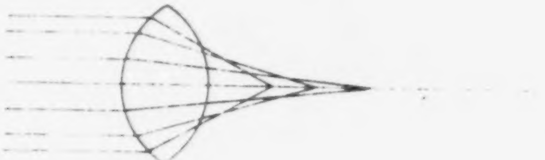

Figure 3-11. Spherical aberration.

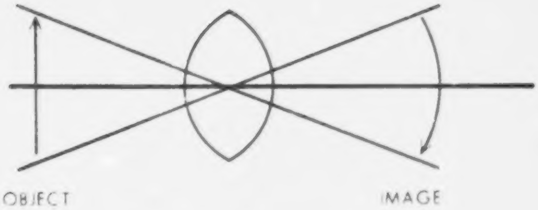

Figure 3-12. Curvature of field.

Exercises (416):

1. Match each characteristic in column A with the lens defect it applies to in column B.

Column A

____ (1) Varies with surface curves of lens.
____ (2) Causes "barrell" or "pincushion" squares.
____ (3) Is reduced by pupil.
____ (4) Disperses white light into colors.

Column B

a. Chromatic aberration.
b. Distortion.
c. Curvature of field.
d. Radial astigmatism.
e. Spherical aberration.

2. Match the locations of the base curve (in column B) with the indicated lens for each item given in column A.

Column A

____ (1) Plus sphere.
____ (2) Spherocylinder, plus cylinder form.
____ (3) Spherocylinder, minus cylinder form.
____ (4) Bifocal, minus cylinder form.

Column B

a. Front surface.
b. Rear (ocular) surface.
c. Weakest curve on front.
d. Weakest curve on back.

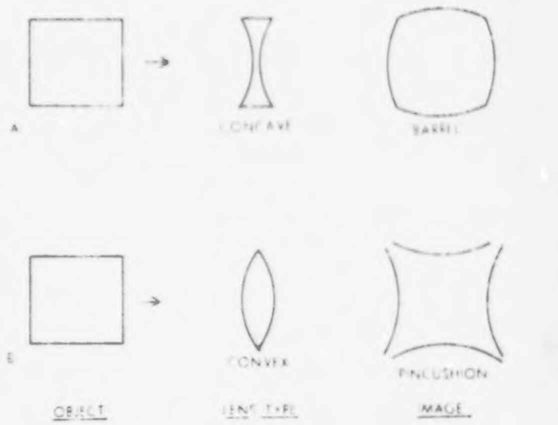

Figure 3-13. Distortion.

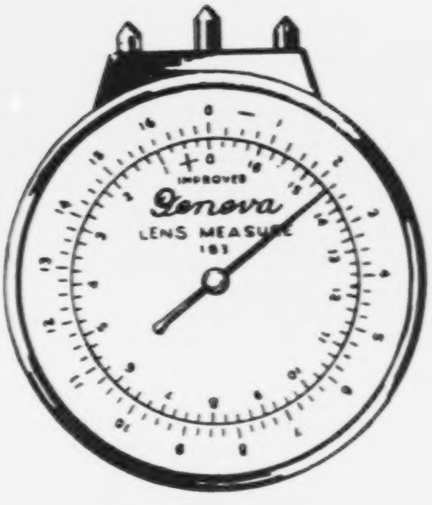

Figure 3–14. Lens clock.

3-5. Effect of Lenses on Patient Comfort

You have already learned a little about the refractive states of the eye and how aberrations affect patient adaptation. But just how do lenses and prisms affect the refractive status and patient comfort? Information of this type, when explained correctly, is useful not only to yourself by also to the patient. This section will also give you an idea of what the patient may experience when wearing an improper correction.

417. Given specific changes in lens prescriptions, predict the probably effect of each change on (1) an astigmatic (2) a myopic, or (3) a hyperopic eye.

Farpoint Effects. Most people use their eyes to see at *two* primary working distances. One of these working distances is at or near optical infinity (farpoint), while the other is at the person's particular reading distance (nearpoint). Lenses affect the various ametropias in different ways, depending upon both the ametropia and the working distance. The next several paragraphs will explain the effects of lenses upon farpoint visual comfort.

Emmetropes. You will remember that the definition of an emmetropic eye is an eye in which light from infinity focuses on the retina even though the ciliary body is relaxed. (See diagram A in fig. 3-15.) This simply means that an image of a distant object is clear, without effort on the part of the ciliary body. If our friend Edgar Emmetrope looked through somebody's reading (+) glasses at some distant object, the image of that object would blur. Since the ciliary body would be totally relaxed (as depicted in fig. 3-15,A), it could not relax any further to decrease the excessive plus power (shown in fig. 3-15,B). Thus Edgar Emmetrope would see distant objects blurred. Prediction: Edgar wouldn't wear these glasses long.

Now suppose that Edgar put on somebody's distance (−) glasses (depicted in fig. 3-15,C). The light emerging from the lens, being divergent in nature, would cause the ciliary body to constrict reflexly and add plus power to the crystalline lens. The minus wavefront would be cancelled by the additional plus power of the crystalline lens, and the distant object would remain clear. However, the optics of the system would cause the distant image to appear smaller. Edgar might like these glasses for awhile, since everything would appear bright and sharp, but an accommodative headache might appear.

Hyperopes. Along comes Hilary N. Hyperope (the "N" stands for "nonpresbyopic). Some folks call her farsighted," but we will see why that is wrong. Hilary N. Hyperope must constantly activate her ciliary body, even to see things far away, but since she is nonpresbyopic, she has enough plus power in her crystalline lens to accommodate and overcome the excessive minus in the rest of her eye's optical system. A hyperope with no glasses is similar to an emmetrope wearing minus lenses. (See fig. 3-16,A).

If Hilary N. Hyperope puts on some plus lenses, she could still see clearly as long as the amount of plus does not exceed the extra effort of her ciliary body. When the plus lens is exactly equal to her refractive error, the ciliary body will be totally relaxed, like that shown in figure 3-15,A. But too much plus would start to blur Hilary's vision like that shown in figure 3-15,B. Conclusion: Hypropes usually like a little plus, but sometimes it takes time for the ciliary body to relax completely (especially if the hyperope only wears his glasses occasionally). Consequently, the patient will complain of a farpoint blur.

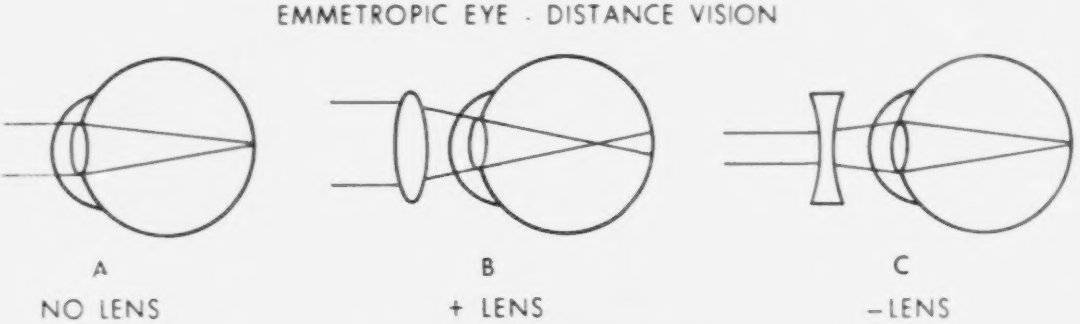

Figure 3–15. Farpoint effect of lenses upon the emmetropic eye.

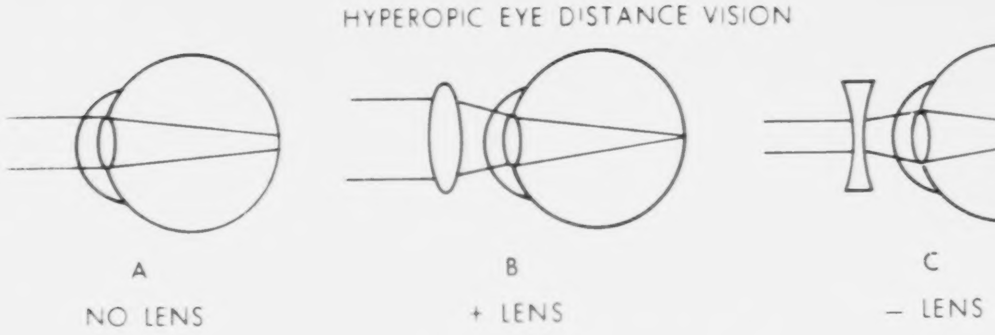

Figure 3–16. Farpoint effect of lenses upon the hyperopic eye.

If Hilary N. Hyperope puts on some minus lenses, she could accommodate a little more and wouldn't have too many complaints, exept for possible headaches.

Myopes. What happens when Melvin Myope tries the same series of lenses? As you remember, a myope's optical system has too much plus power, so light focuses before it gets to the retina. Since the eye cannot reduce plus power beyond the point equivalent to total relaxation of the ciliary sphincter, distant objects are blurred. (See fig. 3-17,A.) Note the similarity to figure 3-15,B—the overplussed emmetrope. If we add more plus power, (as shown in fig. 3-17,B), the blur increases. If we add minus power (as shown in fig. 3-17,C), the blur decreases until light focuses on the retina like that shown in figure 3-15,A. If the minus power is increased, the myope accommodates as that shown in figure 3-15,C.

One of the difficulties in an optometric examination is determining just how much plus or minus to give the patient. With too much plus, the image will be blurred, with too much minus, the minified of the image combined with overaccommodation will lead to adaptive problems. Unfortunately, most patients like minus in the eye lane, but they return with complaints if they get too much of it.

Nearpoint Effects. Let's further investigate the effects of lenses on focusing. So far we have studied only *farpoint* effects on the nonpresbyopic eye. What about reading and other nearpoint effects?

Holding an object up close, as in reading, causes the emitted light wavefront to have minus power. A nonpresbyopic emmetrope or nonpresbyopic hyperope has to accommodate to focus the light on the retina. (See fig. 3-17,A, and fig. 3-19,A). But a myope may not have to accommodate at all if the myopia is great enough. (See fig. 3-20,A.) Presbyopic emmetropes and hyperopes cannot compensate for the excess minus and see near objects as blurry images. A plus lens, designed to replace the lost plus power due to presbyopia, will put the focus back on the retina. (See fig. 3-18,C, and fig. 3-19,C.) Presbyopic myopes have few or no nearpoint complaints, depending upon their refractive error. (See fig. 3-20,C.)

Binocular Effects. So far we have considered each eye individually. What happens when both eyes are used together, as in binocular vision?

The accommodative (focusing) and convergence (fusion) mechanism of the eye are hooked together neurologically. When someone looks from a distant to a near object, the

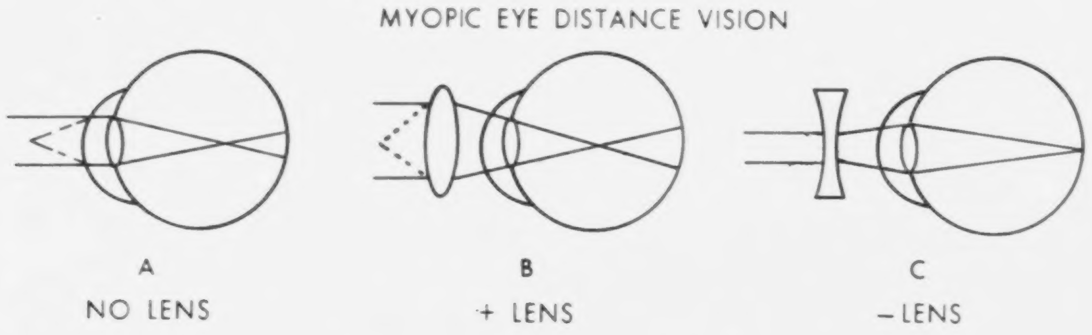

Figure 3–17. Farpoint effect of lenses upon the myopic eye.

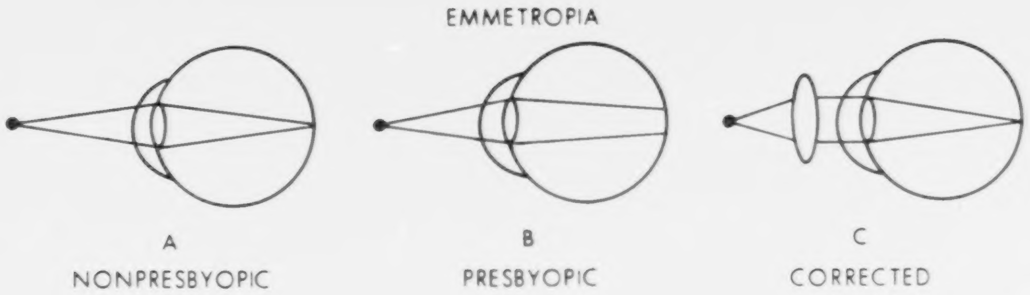

Figure 3–18. Near point effect of lenses upon the emmetropic eye.

eyes both converge and accommodate to keep the perceived image both single and clear. The relative amounts of convergence and accommodation necessary to maintain single binocular vision are learned relatively early in life, and any interference with one causes a reflex change in the other. A hyperope looking at a distant object must accommodate but not converge. A myope looking at a near object may have to converge but not accommodate. Let's give Melvin, our myope, some minus lenses to correct his myopia. Now he must converge *and* accommodate to look at a near object. Since he had previously learned to converge without accommodation, the accommodative effort may cause excess convergence, with a resultant esophoria at nearpoint. The effect of various lenses on phorias is a complicated subject but can be summed up in this statement: plus lenses induce or increase exophoria, while minus lenses induce or increase esophoria when the patient looks through the lens.

You have learned that a patient looking through a lens at a point other than the optical center will experience prism effects, causing a change in vergence. Any error in decentration, combined with any error in Rx power, may cause sufficient focusing and convergence problems to induce the patient to come running back to the clinic with severe complaints. These changes in perception may be present even if the Rx is correct. They may be due entirely to the change of vision experienced with the new glasses.

Patient Complaints. The following list indicates the possible patient complaints that may be induced by a prescription change, even if the change is correct. The symptoms are proportional to the amount of change. Any prescription error multiplies these symptoms greatly.

Increased minus. Things appear smaller and therefore further away to a patient. The patient experiences difficulty in reading for extended periods of time. Or, things may appear closer (due to increased accommodation), but headaches are likely.

Increased plus. Some patients may have blurred distance vision and depth perception changes. They may experience possible dizziness when walking. They may hold reading material too close.

Cylinder power or axis change. Some patients may experience severe depth perception changes, may have occasional nausea and headaches, and may perceive a tilting or slanting of objects.

Base curve change. Magnification difference will probably cause depth perception complaints.

First bifocals. Some patients can't find their bifocals. They will have trouble walking. They will tilt thier head if the bifocals are too high or too low.

Prism. Some patients will possibly experience diplopia. They will have depth perception changes and headaches. Their complaint may be, "Things move when I move my head."

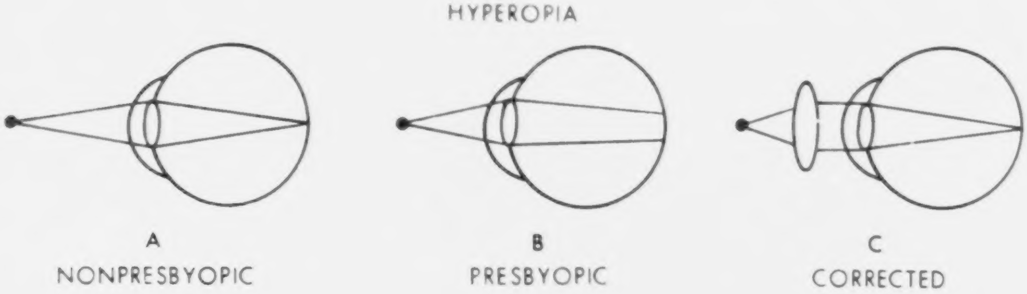

Figure 3–19. Nearpoint effect of lenses upon the hyperopic eye.

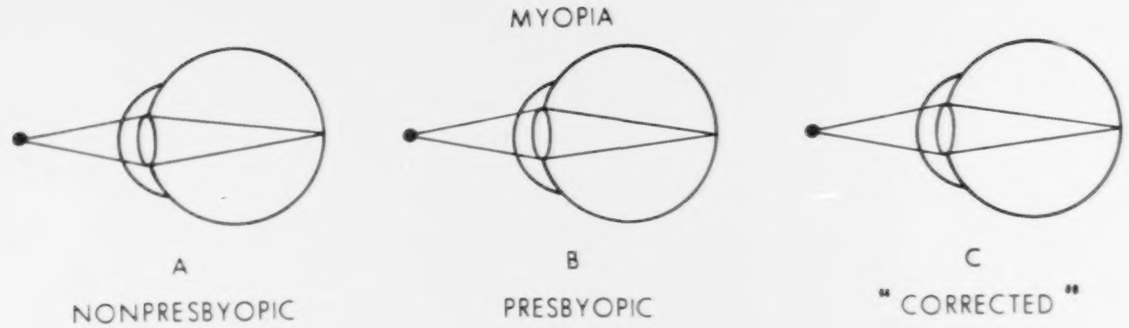

Figure 3–20. Nearpoint effect of lenses upon the myopic eye.

Exercises (417):

1. Given the types of eye disorders listed in column A and the prescription change shown for each in column B, briefly state in column C the probable adaptive problem or new complaint resulting from each change.

Column A	*Column B*	*Column C*
(1) Myope.	Decreased minus.	____________
(2) Hyperope.	Decreased plus.	____________
(3) Astigmat.	Increased cylinder power.	____________
(4) Presbyope.	Increased plus.	____________
(5) Myope.	Increased minus.	____________
(6) Presbyope.	Segment height lowered.	____________
(7) Hyperope.	Increased plus.	____________
(8) Astigmat.	Axis change.	____________
(9) Presbyope.	Segment height raised.	____________

3-6. Modification of Spectacle Prescriptions

Imagine yourself sitting at your desk verifying the latest spectacle delivery. You will probably find several pairs of glasses that don't meet the standards listed earlier in this volume. This section discusses what you can do to insure that the patient receives a high-quality product.

418. Associate given spectacle problems with the procedures they require, and convert given bifocal Rxs into reading glasses form.

Problems Common to Single-Vision and Multifocal Lenses. Laboratory and/or clinic errors may occur in both single-vision Rxs and multifocal Rxs. The next few paragraphs describe some of the most often encountered problems and the solutions to these problems.

Axis misalignment. Quite frequently, a lens will arrive badly misaligned in the frame. What procedure should you follow to realign the axis? Do this, as applicable:

a. Plastic frames. Heat the glasses in your framewarmer. Graps the misaligned lens with your rubberjawed axis alignment pliers and gently rotate the lens in the eyewire. Remember that 0° corresponds to the patients' left temple while they are wearing the glasses; therefore, you should rotate the lens axis *away from* the temple if you want to *increase* the axis reading or toward the left temple if you want to *decrease* the axis reading. Rotating the lens more than about ° will cause the frame to appear lopsided; therefore, if it takes more than ° of rotation to bring the axis back to tolerance, send the spectacles back to the lab for a new lens. Rotating a pair of bifocals to realign the cylinder axis may causes the segments to appear tilted and cosmetically unacceptable. If any of your bifocal Rxs have significant axis errors, send them back to the lab. Sometimes you may wish to rotate a bifocal Rx to realign the segments and make them cosmetically acceptable. If the Rx is a spherocylinder, recheck the cylinder axis after realignment in order to verify that they are still within tolerance. If the Rx is a sphere, no problems are anticipated.

b. Wire frames. The axis adjustment in the aircrew frame is critical and cannot be modified more than ° or 2°. Send any lenses that are off tolerance back to the lab.

Power errors. If the error is outside of tolerance, return the glasses to the lab. If the patient is in dire need of something to see with, use a spherical equivalent lens as an emergency pair. Sometimes the lab makes an error in inserting the lens in the frame and mounts the right lens in the left eyewire and viceversa. If you notice this, simply switch lenses, eye for eye.

Frame size substitution. If the bridge is the wrong size, you may switch the lenses to a frame with the proper bridge taken from your clinic stock. Sometimes a patient requests a replacement ment frame and you do not have the exact size in stock. You may then attempt to modify an available frame to fit the patient's lenses. The plastic spectacle frame will stretch enough to fit the next larger eyesize with a lot of hard work, but it will not easily shrink to fit a smaller eyesize. In order to stretch the frame, thoroughly warm the plastic; then firmly attempt to insert the lens from the front, stretching the warm eyewire as you proceed. Several reheatings of the frame may be necessary. After the lens is set in the stretched eyewire, remove the lens once more, if necessary warm the frame a little, slip the lens in and immerse the hot frame in cold water. This will shrink the plastic so that it will fit snugly around the lens.

Surface scratches. Sometimes a lens with whitish surface smudges will be received from the lab. These smudges may be watermarks or evaporated lens-polishing compound. If so, they may be removed with a typewriter eraser or a good detergent. Sometimes these marks are due to slippage of the rubber chuck that holds the lens in the edges. If this is the case, the lens surface is abraded and the lens should be returned to the lab.

Plastic lenses have a high susceptibility to scratches. Minor surface scratches may be reduced by applying either a commercially available plastic lens refinisher or stocklisted "Polishing Compound, Plastic." Both do a good job. You may remind patients *not* to wipe a dry lens with a dry cloth. They should rinse the lens first. They should never use the paper-type lens cleaner (Sight-Savers) to clean their plastic lenses.

Bifocal Problems. Sometimes bifocal-wearers use their eyes in a situation where an extremely large near field of view is necessary or where distance vision is unnecessary. You may convert their bifocal Rx to a reading Rx by changing to plus cylinder form and adding the "add" to the sphere. The result is the new reading glass Rx.

Study the following example:

Bifocal Rx

OD +2.00 −1.00 × 180
OS 2.50 −0.75 × 180
Add +1.50

Reading Rx Conversion

Step 1. Convert to plus cylinder.
OD +1.00 +1.00 × 90
OS +1.75 +0.75 × 90

Step 2. Add "add."
OD (+1.00 −1.50) +1.00 × 90
OS (+1.75 +1.50) +0.75 × 90

Step 3. New Rx.
OD +2.50 +1.00 × 90
OS +3.25 +0.75 × 90

In this example, note that the new Rx is moderately high if converted to minus cylinder; therefore, go to:

Step 4. Reconvert to minus cylinder (plastic lens).
OD +3.50 −1.00 × 180
OS +4.00 −0.75 × 180

The following is an example where step 4 reconversion is unnecessary:

Rx

OD pl −0.50 × 90
OS −0.25 −1.00 × 75
Add +1.50

Conversion

Step 1.
OD −0.50 +0.50 × 180
OS −1.25 +1.00 × 165

Step 2.
OD (−0.50 +1.50) +0.50 × 180
OS (−1.25 +1.50) +1.00 × 165

Step 3.
OD +1.00 +0.50 × 180
OS +0.25 +1.00 × 165

When ordering reading glasses from bifocals, don't forget to use the *near* PD.

Exercises (418):

1. The latest spectacle delivery to your clinic includes glasses with the prescription errors listed in column A. Select the specific action shown in column B that best solves each situation given in column A, and place the letter of the column B item in the appropriate space. Column B items may be used once, more than once, or not at all.

Column A

____ (1) 1.00 cylinder off 2°.
____ (2) +1.50 cylinder off 6°.
____ (3) Broken −3.00 −1.00 × 180 lens.
____ (4) Bridge too narrow.
____ (5) Lenses seem loose.
____ (6) Polishing compound on lens.
____ (7) Frame misaligned on head.

Column B

1. Return to lab.
2. Use spherical equivalent.
3. Rotate axis.
4. Issue new frame.
5. Modify or repair in clinic.

2. Convert the following bifocal Rxs into a form appropriate for reading glasses:

a. OD +0.75 −0.75 × 090
OS +1.00 −0.50 × 090
Add +1.50

b. OD −1.25 sph
OS −1.25 sph
Add +1.25

c. OD +1.50 −0.50 × 090
OS +1.50 −0.50 × 090
Add +1.75

d. OD −2.75 −0.75 × 075
OS −3.00 −0.50 × 115
Add +2.00

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American National Standards Recommendations for Prescription Opthalmic Lenses. New York: American National Standards Institute, 1979.

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AD12603 *Lensometer*—American Optical Corporation, Buffalo, New York.

NOTE: None of the items listed in the bibliography are available through ECI. If you cannot borrow them from local sources, such as your base library or local library, you may request one item at a time on a loan basis from the AU Library, Maxwell AFB Al 36112, ATTN: ECI Bibliographic Assistant. However, the AU Library generally lends only *books* and a limited number of ***AFMs***. TOs, classified publications, and other types of publications are *not* available. Refer to current indexes for the latest revisions of and changes to the official publications listed in the bibliography.

ANSWERS FOR EXERCISES

CHAPTER 1

Reference:

400 – 1. S–10 refers to the shape of the pattern used to cut the lens for the frame. "10" refers to a 10 mm difference between the height and the width of the lens.

400 – 2. Cellulose nitrate burns easily and very rapidly.
Cellulose acetate is a little more fireproof.

400 – 3. The first size applies to military orders, the second to civilian.

400 – 4. 52/20.

400 – 5. 44/24.

401 – 1. CR–39 plastic.

401 – 2. Chemical process.

401 – 3. 15% and 31%.

401 – 4. Magnesium floride.

402 – 1. Trifocal.

402 – 2. Whether the sphere reading of the distant portion is over ± 5.00.

402 – 3. D–25.

402 – 4. 50.

402 – 5. The lower limbus.

402 – 6. 1½.

403 – 1. Eye size, bridge size and type, and temple length and type.

403 – 2.
- a. 8 mm.
- b. 6 mm.
- c. 7 mm.
- d. 4 mm.
- e. 5 mm.
- f. 7 mm.

403 – 3.
- a. FPD = 72, PPD = 59, d = 6.5 mm. Maximum d from table 1-3 is 3 mm; so an error of 3.5 per lens exists.
  OD $-4.00 \times 0.35 = 1.4^{\Delta}$ BI.
  OS $-3.50 \times 0.35 = 1.22^{\Delta}$ BI.
  Total prism = 2.62^{Δ} BI.
- b. FPD = 70, PPD = 62, d = 4 mm. Maximum d from table 1-3 is 4 mm; no error exists.

403 – 4. Maximum prism error is $2/3^{\Delta}$ horizontal and $1/3^{\Delta}$ vertical.

404 – 1. F. These inserts will not fit interchangeably completely.

404 – 2. T.

404 – 3. T.

404 – 4. F. 66 mm.

404 – 5. F. Yes, there is.

404 – 6. F. 50–26.

405 – 1.
- a. Snipe nose or half-round pliers.
- b. Peening pliers.
- c. File.
- d. Axis alignment pliers.
- e. Endpiece gripping plier and the angling plier.

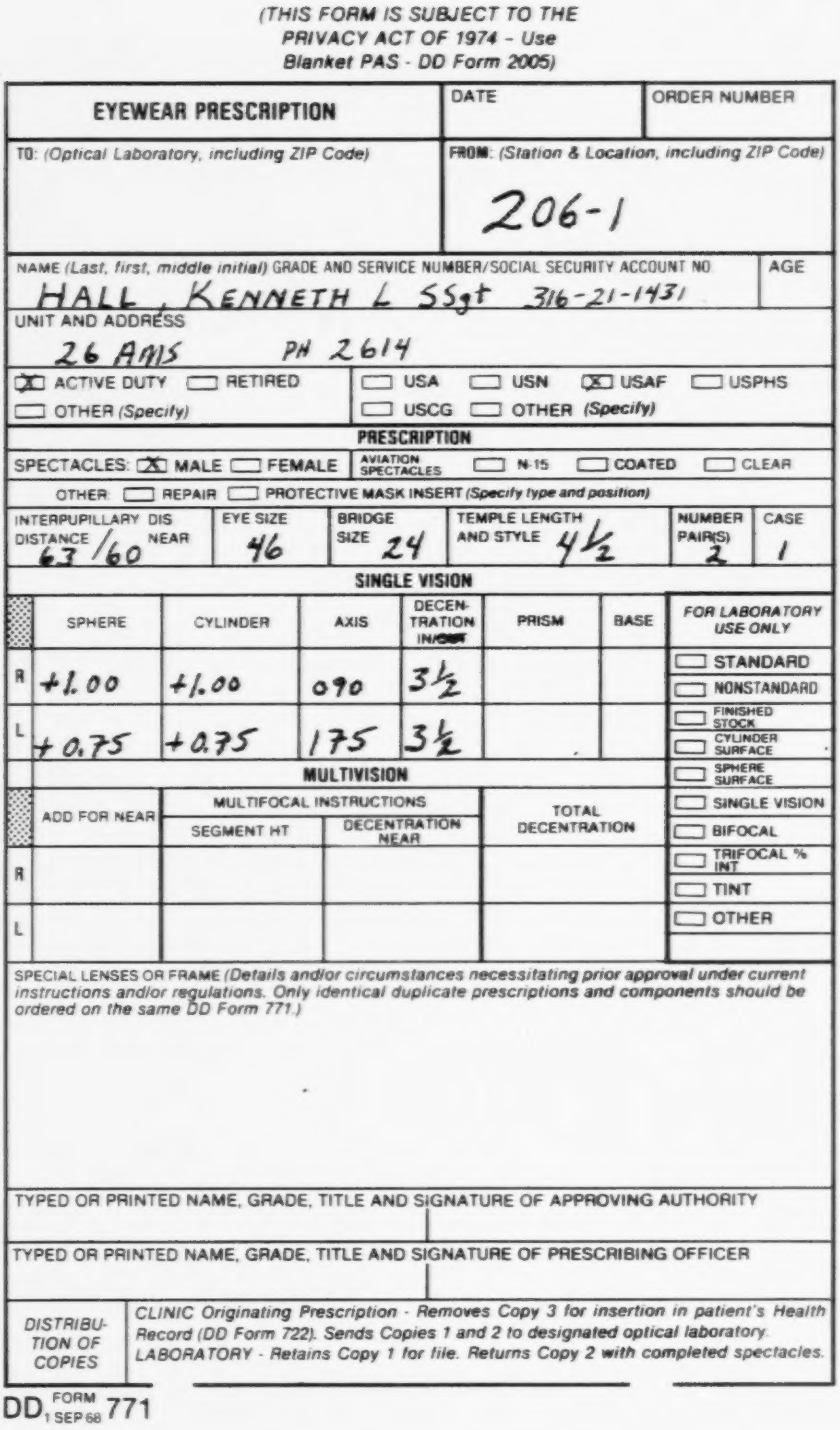
405 – 2.
- a. Bend back of left temple down or back of right temple up.
- b. Reduce pantoscopic angle.
- c. File endpieces.
- d. Reshape temple ends.
- e. Narrow the spread of nosepads or use a narrower bridge.

405 – 3. (1) Check that the lenses are straight in the rims and that axis are aligned properly. (2) Be sure that the pads lie evenly or flat on the side of the nose and that the temples spread so that they will not bind the sides of the patient's head. (3) Be sure that the temples conform to the back of the ear and that the front is bent to the desired pantoscopic or retroscopic tilt. (4) Note the height and horizontal position of each lens on the face, raising or lowering retroscopic or pantoscopic tilt of the endpiece as necessary. (5) Note the height of the glasses on the face. (6) Note the distance of the glasses from the cornea. (7) Note the distance of each lens from the nose, then make a general checkup of all previous adjustments.

406 – 1.
- a. 7.
- b. 2.
- c. 1.
- d. 5.
- e. 6.
- f. 3.
- g. 4.

406 – 2. First, heat the rim in the bead bath until it it soft. When the rim is soft, push the lens out toward the front, starting with the nasal edge. Allow the frame to cool in air, unless the rim is too large (in that case, use water).

407 – 1.
- a. +3.75 sph.
- b. −7.00 sph.
- c. +2.50 sph.
- d. None (plano sph).



(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: *(Optical Laboratory, including ZIP Code)*

FROM: *(Station & Location, including ZIP Code)* 206-1

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO: HALL, KENNETH L SSgt 316-21-1431

AGE

UNIT AND ADDRESS: 26 AMS PH 2614

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE

AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
63 / 60	46	24	4½	2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/~~OUT~~	PRISM	BASE
R	+1.00	+1.00	090	3½		
L	+0.75	+0.75	175	3½		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY

☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES: *CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

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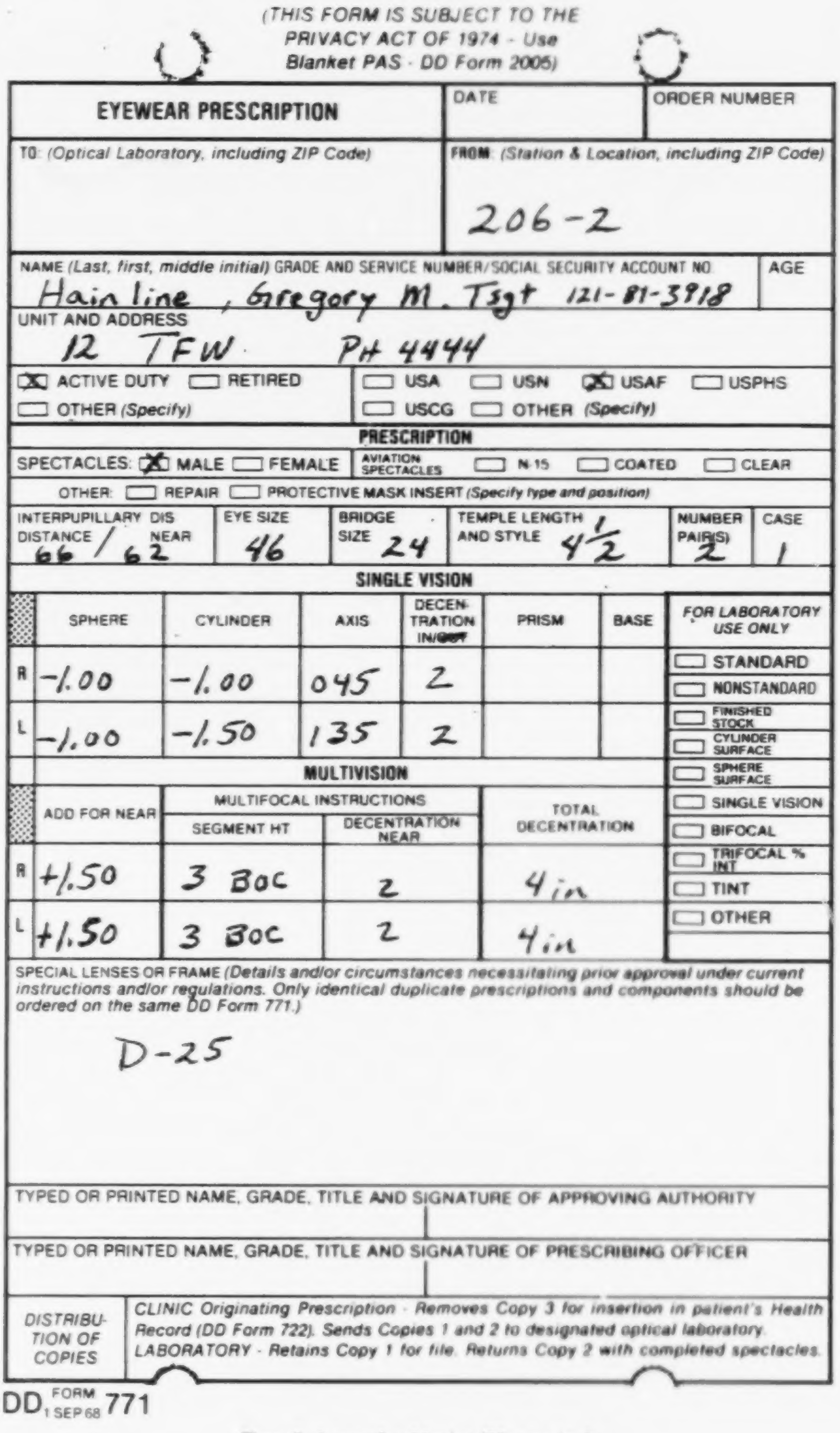
Figure 1. Answer for objective 408, exercise 1.



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EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)* 206-2	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. Hainline, Gregory M. Tsgt 121-81-3918		AGE

UNIT AND ADDRESS
12 TFW PH 4444

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE

AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 / 62	46	24	4 1/2	2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/~~OUT~~	PRISM	BASE
R	-1.00	-1.00	045	2		
L	-1.00	-1.50	135	2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+1.50	3 Boc	2	4 in
L	+1.50	3 Boc	2	4 in

FOR LABORATORY USE ONLY
- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

D-25

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TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

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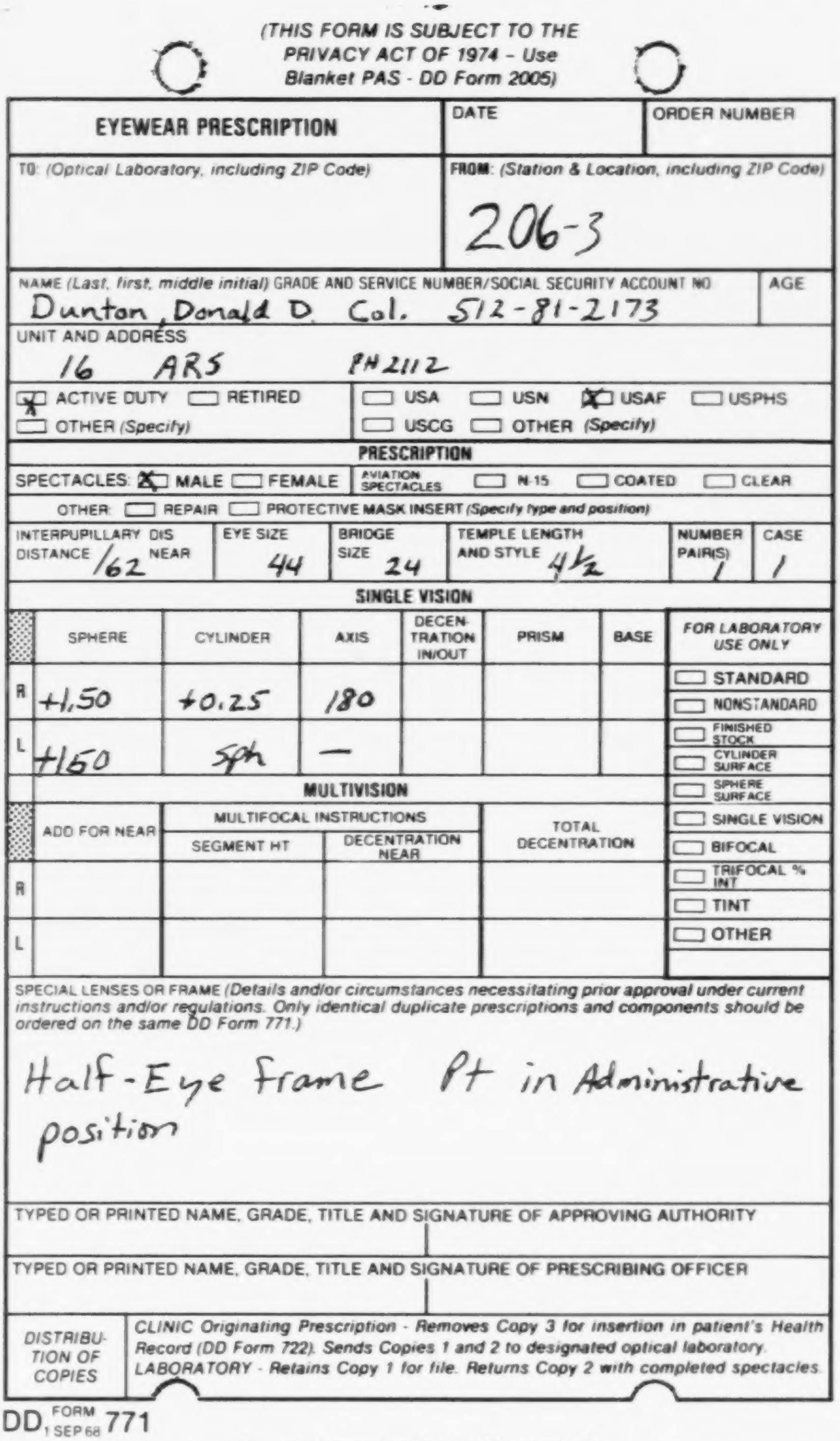
Figure 2. Answer for objective 408, exercise 2.



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EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	**FROM:** *(Station & Location, including ZIP Code)* 206-3	

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO Dunton, Donald D. Col. 512-81-2173	AGE
UNIT AND ADDRESS 16 ARS PH2112	
☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
/62	44	24	4½	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	+1.50	+0.25	180			
L	+150	sph	—			

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY

- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

Half-Eye frame Pt in Administrative position

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

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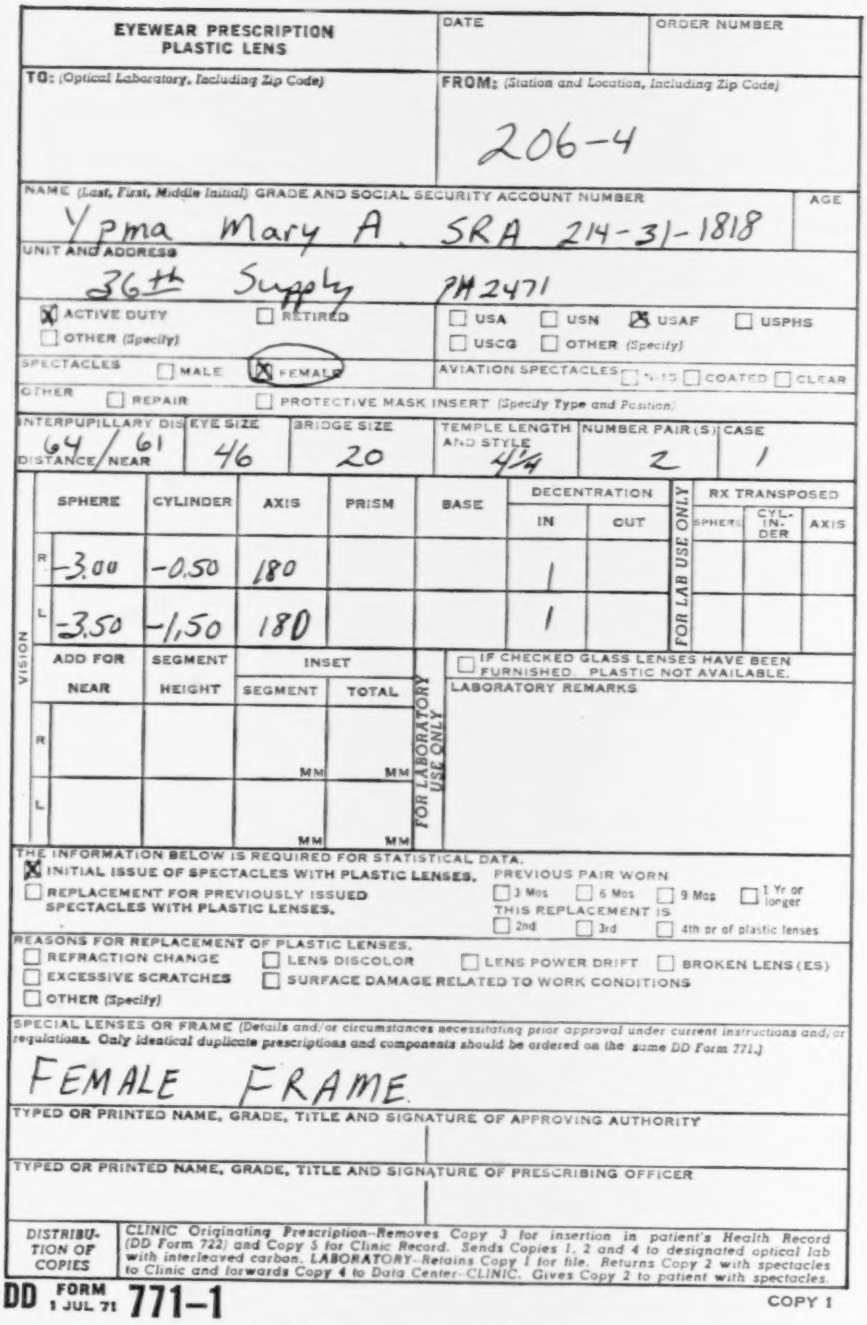
Figure 3. Answer for objective 408, exercise 3.



EYEWEAR PRESCRIPTION PLASTIC LENS

DATE

ORDER NUMBER

TO: *(Optical Laboratory, Including Zip Code)*

FROM: *(Station and Location, Including Zip Code)*
206-4

NAME *(Last, First, Middle Initial)* GRADE AND SOCIAL SECURITY ACCOUNT NUMBER
Ypma Mary A. SRA 214-31-1818

AGE

UNIT AND ADDRESS
36th Supply PH 2471

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

SPECTACLES ☐ MALE [✓ ☒ FEMALE]

AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify Type and Position)*

INTERPUPILLARY DIS DISTANCE/NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
64/61	46	20	4¼	2	1

VISION

	SPHERE	CYLINDER	AXIS	PRISM	BASE	DECENTRATION		FOR LAB USE ONLY	RX TRANSPOSED		
						IN	OUT		SPHERE	CYL-IN-DER	AXIS
R	-3.00	-0.50	180			1					
L	-3.50	-1.50	180			1					

	ADD FOR NEAR	SEGMENT HEIGHT	INSET		FOR LABORATORY USE ONLY
			SEGMENT	TOTAL	
R			MM	MM	
L			MM	MM	

☐ IF CHECKED GLASS LENSES HAVE BEEN FURNISHED. PLASTIC NOT AVAILABLE.

LABORATORY REMARKS

THE INFORMATION BELOW IS REQUIRED FOR STATISTICAL DATA.

☒ INITIAL ISSUE OF SPECTACLES WITH PLASTIC LENSES.

☐ REPLACEMENT FOR PREVIOUSLY ISSUED SPECTACLES WITH PLASTIC LENSES.

PREVIOUS PAIR WORN ☐ 3 Mos ☐ 6 Mos ☐ 9 Mos ☐ 1 Yr or longer

THIS REPLACEMENT IS ☐ 2nd ☐ 3rd ☐ 4th or of plastic lenses

REASONS FOR REPLACEMENT OF PLASTIC LENSES.

☐ REFRACTION CHANGE ☐ LENS DISCOLOR ☐ LENS POWER DRIFT ☐ BROKEN LENS (ES)

☐ EXCESSIVE SCRATCHES ☐ SURFACE DAMAGE RELATED TO WORK CONDITIONS

☐ OTHER *(Specify)*

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

FEMALE FRAME

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription--Removes Copy 3 for insertion in patient's Health Record (DD Form 722) and Copy 5 for Clinic Record. Sends Copies 1, 2 and 4 to designated optical lab with interleaved carbon. LABORATORY--Retains Copy 1 for file. Returns Copy 2 with spectacles to Clinic and forwards Copy 4 to Data Center--CLINIC. Gives Copy 2 to patient with spectacles.*

DD FORM 1 JUL 71 771-1

COPY 1

Figure 4. Answer for objective 408, exercise 4.

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409 – 1. Most civilian labs grind cylinder on the back side of a lens indicating minus cylinder, and the military grind theirs on the front side indicating plus cylinder.

409 – 2. Yes and no. Little Johnny's vision is getting poorer, but that is because the optics of his eyes are too strong, mathematically speaking.

409 – 3. Astigmatism isn't a disease. The word means part of each of your eyes have different refractive powers. Special lenses will compensate for this refractive error, but nothing will "correct" it.

409 – 4. No. Simple hyperopia means that your entire eye is equally (or simply) hyperopic (or farsighted).

409 – 5. The doctor doesn't mean to convert your religion. The term she used means you are losing your near focusing power because you are getting a little older.

409 – 6. Most children with crossed eyes turn off the eye that is crossed in order to prevent their seeing double. The prism that Susie must wear will help her brain put the separate images from her eyes together and will help prevent her eye from turning off or becoming amblyopic.

409 – 7. He probably meant a special prismaic lens called a slab-off. This type of lens will help prevent you from seeing double when you look down or read.

410 – 1. One and 2, daily.

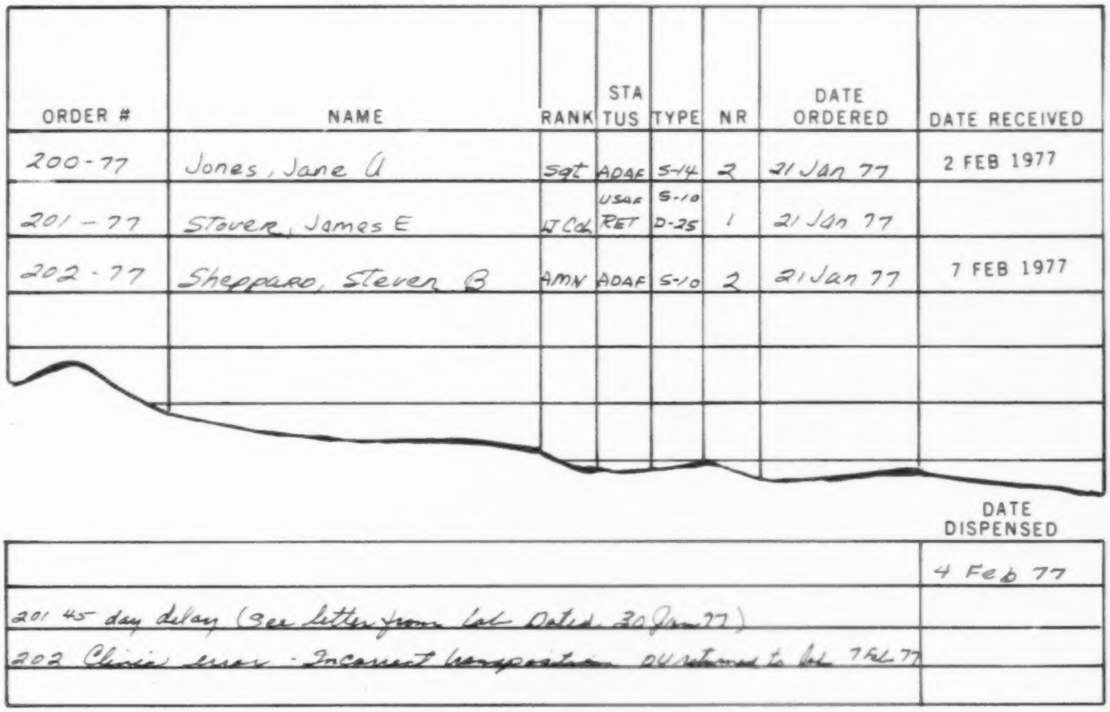
410 – 2. Spectacle order logbook; order numbers, patient's name, rank, and status, types and number of spectacles ordered, dates ordered, received and dispensed, and comments on the status of orders not yet received and on those sent back to the lab.

410 – 3. In your suspense file.

410 – 4. Give copy 2 to the patient; sign, date, and place copy 3 in the patient's medical folder.

410 – 5.

10 - 2.



ORDER #	NAME	RANK	STATUS	TYPE	NR	DATE ORDERED	DATE RECEIVED
200-77	Jones, Jane A	Sgt	ADAF	S-14	2	21 Jan 77	2 FEB 1977
201 – 77	Stover, James E	Lt Col	USAF RET	S-10 D-25	1	21 Jan 77	
202 - 77	Sheppard, Steven B	AMN	ADAF	S-10	2	21 Jan 77	7 FEB 1977

	DATE DISPENSED
	4 Feb 77
201 45 day delay (See letter from lab Dated 30 Jan 77)	
202 Clinic error - Incorrect transposition OU returned to lab 7 Feb 77	

Figure 5. Answer for objective 410, exercise 5.

411 - 1. (1) a.
(2) d.
(3) c.
(4) b.

CHAPTER 3

412 - 1. 0.25 D.
412 - 2. 5°.
412 - 3. 2°.
412 - 4. $1/3^{\Delta}$; 1 mm.
412 - 5. $2/3^{\Delta}$; 2.5 mm.
412 - 6. 1 mm.
412 - 7. 0.75 D.
412 - 8. 3.
412 - 9. Z80.1-1979.

413 - 1. Accept.
413 - 2. Reject.
(1) 0.8^{Δ} error per lens, total over $2/3^{\Delta}$ in horizontal.
(2) Possible clinic error in ordering this frame size.
413 - 3. Reject.
(1) Cylinder power in error, both lenses.
(2) Total of 1^{Δ} error, over $2/3^{\Delta}$.
(3) Sphere power error left lens.
413 - 4. Reject.
(1) Total 1.25^{Δ} error, over $2/3^{\Delta}$ in horizontal.
(2) Segment heights are wrong.
(3) Axis in error.
413 - 5. Reject.
(1) Axis of OS in error.
(2) Add power OU.
(3) Prism power OD.
413 - 6. Accept.

414 - 1. Parallel.
414 - 2. Increases the negative vergence.
414 - 3. Converge.

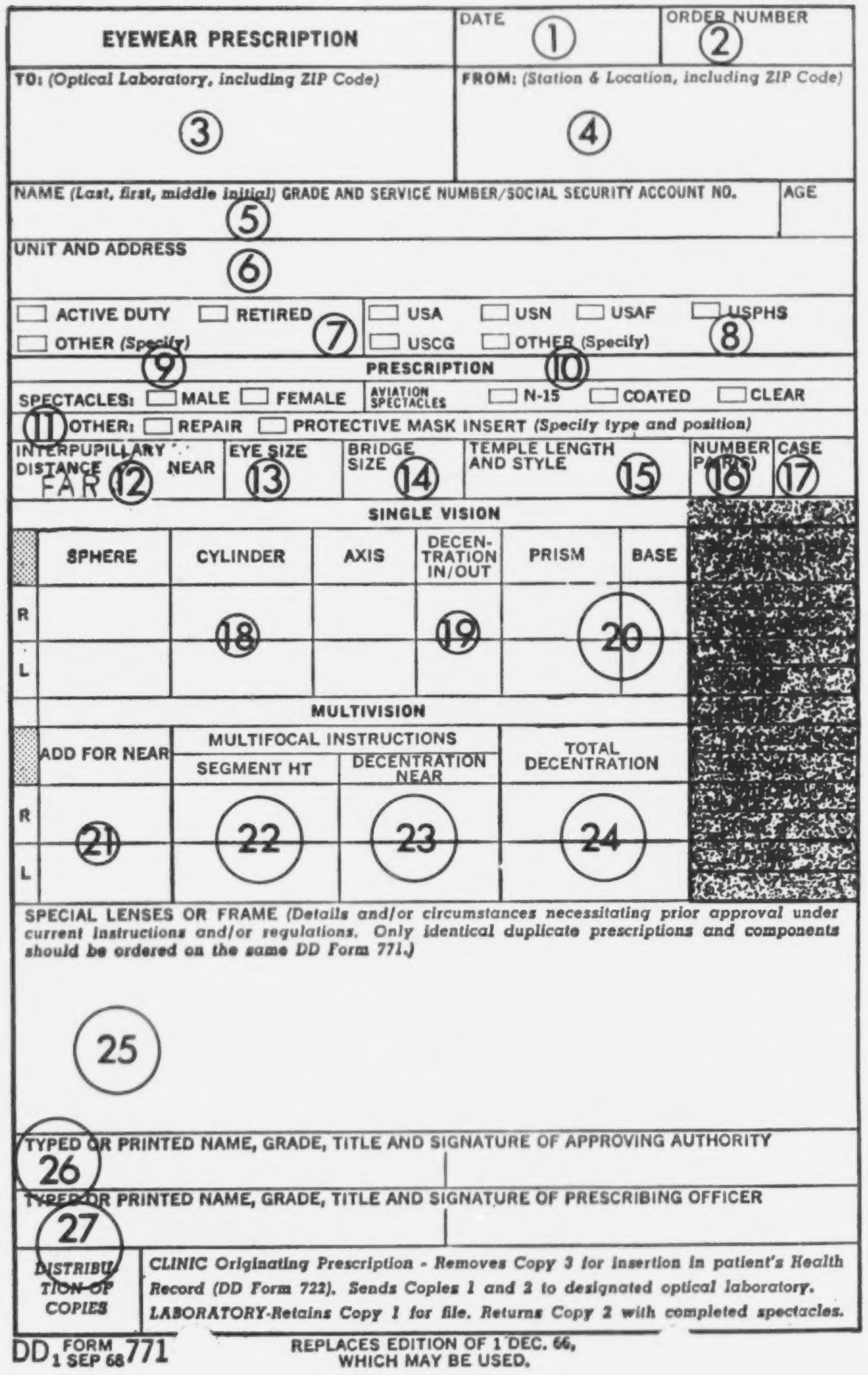
415 - 1. Focusing the eyepiece.
415 - 2. *Stimulate accommodate and cause erroneous readings.*
415 - 3. Convex.
415 - 4. Convex.
415 - 5. It is the difference between them.
415 - 6. Last.
415 - 7. Weaker.
415 - 8. Weaker.

416 - 1. (1) c, d.
(2) b.
(3) e.
(4) a.
416 - 2. (1) b.
(2) c.
(3) d.
(4) a.

417 - 1. (1) Sees blur at farpoint.
(2) Has trouble reading.
(3) Feels dizzy with correction.
(4) Sees far blur with correction; holds things close.
(5) Experiences change in depth perception.
(6) Tilts head back to read.
(7) Sees blur at farpoint.
(8) Lines don t look straight.
(9) Has trouble seeing feet and walking.

418 - 1. (1) c.
(2) a.
(3) a or b.
(4) d or e.
(5) e.
(6) e.
(7) e.

418 - 2. a. OD +1.50 +0.75 × 180.
OS +2.00 +0.50 × 180.
b. Plano—no reading glasses are needed.
c. OD +3.25 −0.50 × 090.
OS +3.25 −0.50 × 090.
d. OD −1.50 +0.75 × 165.
OS −1.50 +0.50 × 025.



EYEWEAR PRESCRIPTION	DATE ①	ORDER NUMBER ②

TO: *(Optical Laboratory, including ZIP Code)* ③

FROM: *(Station & Location, including ZIP Code)* ④

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. ⑤ AGE

UNIT AND ADDRESS ⑥

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)* ⑦ ⑨

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)* ⑧ ⑩

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

⑪ OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE FAR ⑫ NEAR	EYE SIZE ⑬	BRIDGE SIZE ⑭	TEMPLE LENGTH AND STYLE ⑮	NUMBER PAIR(S) ⑯	CASE ⑰

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R		⑱		⑲	⑳	
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	㉑	㉒	㉓	㉔
L				

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

㉕

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY ㉖

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER ㉗

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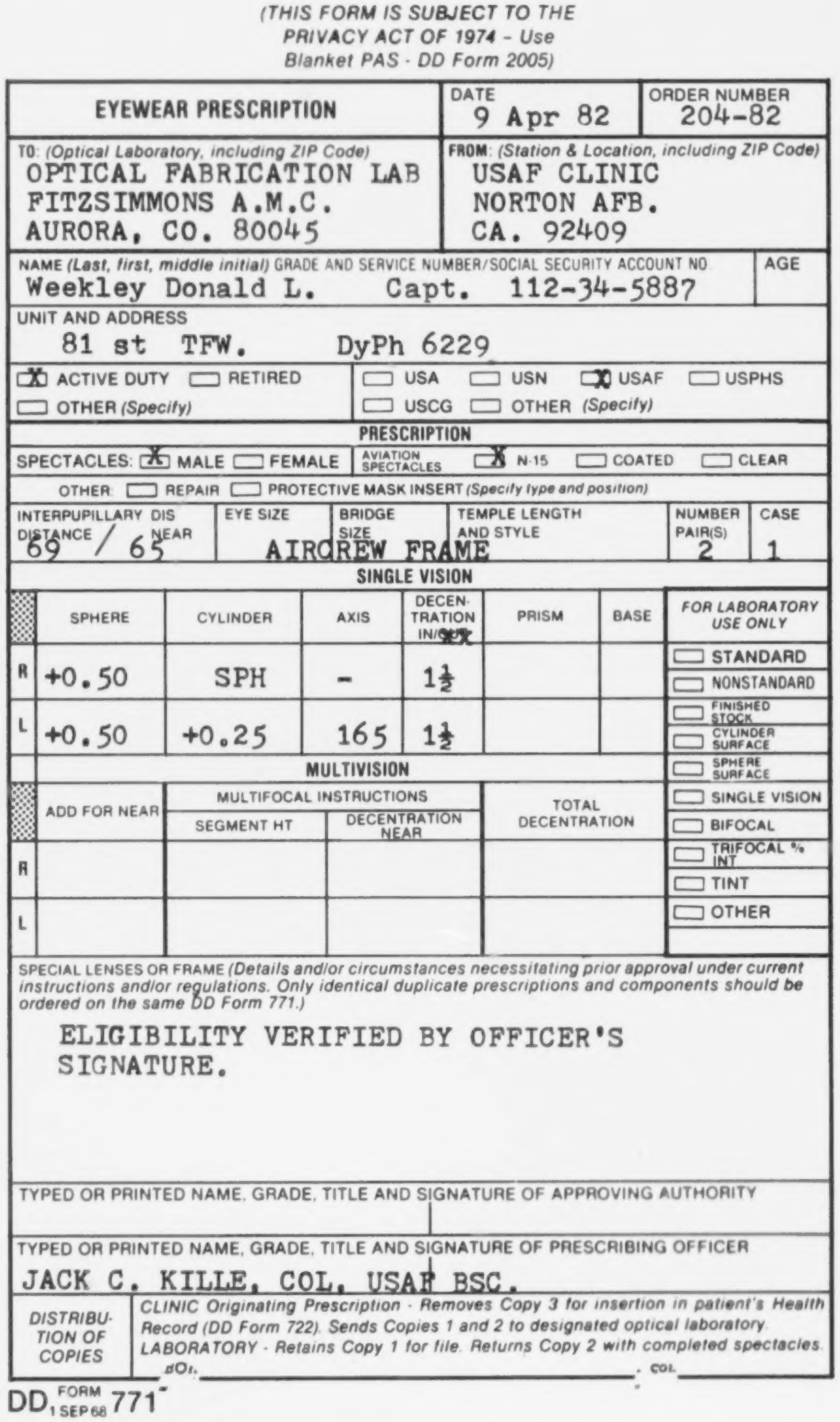
DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.



(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

EYEWEAR PRESCRIPTION	DATE 9 Apr 82	ORDER NUMBER 204-82

TO: *(Optical Laboratory, including ZIP Code)*
OPTICAL FABRICATION LAB
FITZSIMMONS A.M.C.
AURORA, CO. 80045

FROM: *(Station & Location, including ZIP Code)*
USAF CLINIC
NORTON AFB.
CA. 92409

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO: Weekley Donald L. Capt. 112-34-5887 AGE

UNIT AND ADDRESS: 81 st TFW. DyPh 6229

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☒ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
69 / 65	AIRCREW FRAME			2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/~~OUT~~	PRISM	BASE
R	+0.50	SPH	-	1½		
L	+0.50	+0.25	165	1½		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

ELIGIBILITY VERIFIED BY OFFICER'S SIGNATURE.

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
JACK C. KILLE, COL, USAF BSC.

DISTRIBUTION OF COPIES: *CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771

Foldout 1. Instructions for completing DD Form 771 and DD Form 771-1.

BEST COPY AVAILABLE

STOP - 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

91255 03 23
SPECTACLE RELATED PROCEDURES

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet .
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover your answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you have to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If mandatorily enrolled student, process questions or comments through your unit trainer or OJT supervisor. If voluntarily enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the Learning Objective Number where the answer to that item can be located. When answering the items on the VRE, refer to the Learning Objectives indicated by these Numbers. The VRE results will be sent to you on a postcard which will list the actual VRE items you missed. Go to the VRE booklet and locate the Learning Objective Numbers for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the best answer to each question.

1. (400) Military frames procured today are made of

a. cellulose nitrate.
b. cellulose acetate.
c. methyl methacrylate.
d. polymerized zylonate.

2. (400) The standard pattern shape for the women's military frame is the

a. S-7.
b. S-10.
c. S-14.
d. N-15.

3. (400) When discussing the male military frame, the term "S-10" refers to the

a. lens shape.
b. temple type.
c. bridge design.
d. temple length.

4. (400) All military frame measurements are in millimeters except

a. eye size.
b. frame P.D.
c. bridge width.
d. temple length.

5. (401) The plastic material used in lens fabrication is also known as

a. CR-39.
b. CR-69.
c. DR-39.
d. DR-69.

6. (401) Which of the following is the most common method of increasing spectacle lens impact resistance?

a. Heat treatment.
b. Chemical treatment.
c. Increase lens thickness.
d. Laminate with plastic film.

7. (401) Light transmission through the magnesium fluoride coated glass lens is about

a. 31 percent.
b. 85 percent.
c. 89 percent.
d. 97 percent.

8. (402) With special justification the executive bifocal may be replaced by the

a. D-25 Trifocal.
b. D-35 Bifocal.
c. D-40 Bifocal.
d. Kryptok-35.

9. (402) A "one piece" bifocal segment refers to the

a. Executive.
b. Kryptok.
c. ST-25.
d. D-25.

10. (402) The baseline measurement for bifocal height is the distance from the inner edge of the lower eyewire to the

a. lower limbus.
b. optical center.
c. center of the pupil.
d. lower pupillary margin.

11. (403) Army optical laboratories are limited to lens blank sizes of

a. 50 and 54 mm.
b. 54 and 58 mm.
c. 58 and 62 mm.
d. 59 and 64 mm.

12. (403) The maximum decentration available for a 48 mm eye size when using a 58 mm lens blank is

a. 1 mm.
b. 2 mm.
c. 3 mm.
d. 4 mm.

13. (403) What is the maximum unwanted vertical and horizontal prism allowable?

a. 1/4Δ and 1/2Δ.
b. 1/3Δ and 1/3Δ.
c. 1/3Δ and 2/3Δ.
d. 3/4Δ and 1Δ.

14. (404) The frame "PD" of the M-17 protective gas mask insert is

a. 64 mm.
b. 66 mm.
c. 68 mm.
d. 70 mm.

15. (404) The M-17A1 optical insert fits all of the following masks except the

a. M-17.
b. M-25.
c. M-14A2.
d. M-17A1.

16. (404) In order to be authorized gas mask inserts, vehicle operators must have visual acuities less than

a. 20/20.
b. 20/30.
c. 20/40.
d. 20/70.

17. (405) The tool most commonly used to change cylinder axis angle in the zyl frame is the

a. axis alignment pliers.
b. snipe nose pliers.
c. angling pliers.
d. peening pliers.

18. (405) Which of the following pliers is most commonly used for endpiece adjustment?

a. Axis alignment.
b. Temple angling.
c. Snipe nose.
d. Peening.

19. (405) When heating a frame in a salt-filled frame warmer, you should continually move the frame in order to

a. break up salt clumps.
b. estimate its softness.
c. reduce aging of the frame.
d. prevent pitting of the frame.

20. (405) If the bottoms of the eyewires stand out too far from the patient's cheeks, you should

a. increase pantoscopic angle.
b. decrease pantoscopic angle.
c. increase retroscopic angle.
d. increase horizontal angle.

21. (405) The baseline for horizontal alignment of a frame should be the

a. eyebrow.
b. upper limbus.
c. outer canthus.
d. lower eyelashes.

22. (405) The distance of the lenses from the cornea for best optical effects is

a. 13 mm.
b. 13.5 mm.
c. 14 mm.
d. 14.5 mm.

23. (406) The zyl frames are capable of being stretched

a. 1 mm.
b. 1.5 mm.
c. 2 mm.
d. 2.5 mm.

24. (406) How can you best reduce the size of a stretched plastic rim?

a. Using a zylomite expander.
b. Placing in alcohol to soften material.
c. Heating and plunging in cold water.
d. Dipping in an acid solution with a pH factor of less than 6.8.

25. (407) How do you find the power of a sphere that is the best substitute for a spherocylinder lens?

- a. Add half of the cylinder power algebraically to the sphere power.
- b. Add half of the sphere power algebraically to the cylinder power.
- c. Subtract the sphere power from the cylinder power.
- d. Add cylinder power to sphere power.

26. (408) What AF Regulation do you use to locate the optical labs for your area?

- a. AFR 167-3.
- b. AFM 167-3.
- c. SACR 167-3.
- d. AFP 167-3.

27. (408) Which of the following forms is designed only for ordering plastic lenses?

- a. AE Form 1070.
- b. DD Form 771.
- c. DD Form 77.
- d. DD Form 771-1.

28. (408) The intermediate segment height for a trifocal lens is usually

- a. 5 mm.
- b. 6 mm.
- c. 7 mm.
- d. 8 mm.

29. (408) Before signing any spectacle orders, your optometrist must have submitted a completed DD Form 577, Signature Card, to the

- a. Department of Professional Services.
- b. servicing labs.
- c. registrar.
- d. pharmacy.

30. (409) A patient has an ocular optic system which converges light excessively. This defect can be compensated for by moving objects

- a. closer or using a convex lens.
- b. closer or using a concave lens.
- c. farther away or using a convex lens.
- d. farther away or using a concave lens.

31. (409) A patient has an eye which has insufficient converging power. This defect may be compensated for by moving objects

- a. closer or using a convex lens.
- b. closer or using a concave lens.
- c. farther away or using a convex lens.
- d. farther away or using concave lens.

32. (409) When using prism, you should remember that the image is deviated

a. toward the base.
b. toward the apex.
c. in the up direction.
d. in the down direction.

33. (409) A patient who wears a slab-off prism probably has a large

a. anisometropia.
b. aniseikonia.
c. heterotropia.
d. heterophoria.

34. (410) DD Form 771 must be mailed to the optical lab

a. daily.
b. weekly.
c. every Wednesday and Friday.
d. every two weeks.

35. (410) Which copy, if any, of the DD Form 771 is filed at the optical lab?

a. 1.
b. 2.
c. 3.
d. None.

36. (410) Which copy of the DD Form 771 does the patient sign?

a. 1.
b. 2.
c. 3.
d. All.

37. (410) Which of the following provides a consolidated record of your spectacle program?

a. Appointment lists.
b. Copy 2, DD Form 771.
c. The suspense file.
d. A logbook.

38. (410) Spectacles are considered overdue when how many days has elapsed since original order date?

a. 30.
b. 35.
c. 40.
d. 45.

39. (411) Which patient notification system is the most convenient?

a. Distribution.
b. Regular mail.
c. Telephone.
d. Automatic return.

40. (412) Dress safety lenses must be at least how thick?

a. 1.5 mm.
b. 2 mm.
c. 2.5 mm.
d. 3 mm.

41. (412) Which impact resistance treatment to a lens will show the stress patterns?

a. Chemically treated.
b. Stress treated.
c. Plastic coated.
d. Heat treated.

42. (412) What instrument should be used to detect the warpage of an ophthalmic lens?

a. Geneva lens clock.
b. Thickness guage.
c. Lensometer.
d. Slit lamp.

43. (413) Bifocals should not be anymore than how many diopters off to be acceptable?

a. .50 D.
b. .37 D.
c. .25 D.
d. .12 D.

44. (413) What is the most unwanted horizontal prism that can be accepted?

a. 2/3Δ.
b. 1/2Δ.
c. 1/3Δ.
d. 1/4Δ.

45. (414) In order to indicate the lens power, the light leaving an unknown lens in a lensometer must

a. converge into the telescope.
b. converge into the collimator.
c. remain parallel to the telescope.
d. diverge proportionally to the lens power.

46. (414) Which of the following procedures should you try first if your lensometer remains out of focus when the power drum is on "zero"?

a. Realign the power wheel.
b. Compensate the lensometer with prisms.
c. Send the lensometer out for calibration.
d. Compensate the power wheel with plus lenses.

47. (415) The first step in using a lensometer is calibrating the instrument for your eye. This is accomplished by

a. resetting the power drum with its setscrews.
b. rotating the eyepiece focusing ring.
c. centering the mires in the reticle.
d. adjusting the target light distance.

48. (415) What is the best way to measure the power in the bifocal?

a. Convex side facing the nosepiece.
b. Concave side facing the nosepiece.
c. Upside down convex side toward the nosepiece.
d. Upside down concave side toward the nosepiece.

49. (415) When measuring vertical prism, you should first measure and center the lens with the stronger

a. prism power.
b. sphere power.
c. vertical cylinder power.
d. vertical meridian power.

50. (415) The lensometer measures what kind of power?

a. Sphere power.
b. Vertex power.
c. Cylinder power.
d. Vertical power.

51. (416) Which aberration causes different wavelengths of light to focus at different distances from the lens?

a. Coma.
b. Distortion.
c. Chromatic.
d. Radial astigmatism.

52. (416) Which type of aberration causes light striking the lens at an angle to behave as if it were passing through a variable cylinder, even though the lens is spherical?

a. Chromatic.
b. Distortion.
c. Curvature of field.
d. Radial astigmatism.

53. (416) Chief Bickley is a hyperopic S. P. and complains that the perimeter of the fence appears to bulge toward him when he wears his glasses. This illusion is probably due to

a. marginal astigmatism.
b. curvature of field.
c. distoration.
d. coma.

54. (416) The base curve for all military bifocals is the

a. spherical front curve.
b. spherical back curve.
c. weaker front curve.
d. weaker back curve.

55. (417) Sergeant Brick, an emmetrope, tried on his wife's +1.00 reading glasses. You would expect his vision to be

a. clear at far and near.
b. blurry at far and near.
c. blurry at far, and clear at near.
d. clear at far, and blurry at near.

56. (417) A hyperope is erroneously wearing glasses which are "too strong" (have excessive + dioptric power). You should expect

a. visual acuity to be clear at far and near.
b. visual acuity to be blurry at far and near.
c. distance vision to be clear and near vision to be blurry.
d. distance vision to be blurry and near vision to be clear.

57. (417) Plus lenses affect phorias in which way?

a. Exophoria increases.
b. Esophoria increases.
c. Exophoria decreases.
d. Exophoria remains unchanged.

58. (417) If a patient comes in complaining of depth perception problems even though things are clear, they look different in size than with old Rx, what change in the new Rx would you suspect?

a. Increased minus.
b. Increased plus.
c. Changed base curve.
d. Changed cylinder axis.

59. (418) If patient's axis is misaligned 3° above the 145° axis that was ordered on a high cylinder lens, what would you do?

a. Rotate lens away from the left temple.
b. Rotate lens toward the left temple.
c. Send glasses back to lab.
d. Leave the lens alone.

60. (418) A bifocal patient decides single vision reading glasses would be better at work. Which near Rx is correct if the patient wears OD + 1.75 - 0.75 X 152 Add + 2.00 ou. OS + 1.50 - 0.75 X 173

a. OD + 3.75 - 0.75 X 062
   OS + 3.50 - 0.75 X 137
b. OD + 3.00 - 0.75 X 152
   OS + 2.75 - 0.75 X 137
c. OD + 2.00 + 0.75 X 062
   OS + 2.00 + 0.75 X 047
d. OD + 3.00 + 0.75 X 062
   OS + 2.75 + 0.75 X 047

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

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Volume 4

Advanced Optometry Clinic Procedures

Extension Course Institute
Air Training Command

Prepared by
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DEPARTMENT OF THE AIR FORCE
UNITED STATES OF AMERICA

SCHOOL OF HEALTH CARE SCIENCES, USAF (ATC)
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THIS PUBLICATION HAS BEEN REVIEWED AND APPROVED BY COMPETENT PERSONNEL OF THE PREPARING COMMAND IN ACCORDANCE WITH CURRENT DIRECTIVES ON DOCTRINE, POLICY, ESSENTIALITY, PROPRIETY, AND QUALITY.

Preface

THUS FAR in this course, you have learned proper preliminary clinic procedures and how to order, verify, and dispense glasses correctly. In many busy clinics, these procedures are about all you have time to perform, but there are many more procedures for which you are qualified. Using these procedures not only contributes to a sense of personal satisfaction but also widens your opportunities for providing complete visual care for the patient. Among these advanced procedures are specialized techniques, such as contact lens therapy, vision training, tonometry, visual fields, and periodic driver's license examinations. In addition to these areas, we will investigate eye safety programs as they apply to industrial environments, first aid for eye injuries, medical profiling of eye conditions, and referring a patient to another service for treatment. There will also be some new areas covered, such as the slit lamp, radiuscope, and a longer look at the noncontact tonometer and instillation of ophthalmic drugs.

Foldout 1 is printed and bound at the back of this volume. Whenever you are referred to the foldout, please turn to the back of the volume.

Direct your questions or comments relating to the accuracy or currency of this volume to the course author: School of Health Care Sciences, USAF/MSTW, ATTN: TSgt Michael O. Kille, Sheppard AFB TX 76311. If you need an immediate response, call the author, AUTOVON 736-4471, between 0700 and 1600 CST, Monday through Friday. *(NOTE: Do not use the suggestion program to submit changes or corrections for this course.)*

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This volume is valued at 18 hours (6 points).

Material in this volume is technically accurate, adequate, and current as of May 1982.

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NOTE: In this volume, the subject matter is developed by a series of Learning Objectives. Each of these carries a 3-digit number and is in boldface type. Each sets a learning goal for you. The text that follows the objective gives you the information you need to reach that goal. The exercises following the information give you a check on your achievement. When you complete them, see whether your answers match those in the back of this volume. If your response to an exercise is incorrect, review the objective and its text.

Specialized Clinical Techniques

MOST PEOPLE think of the optometry clinic as a place to have their eyes examined while they wait or, maybe, as a spectacle sales and repair shop. This image of optometry has its origins in the itinerant spectacle peddlers of a century ago. Although the prescribing and dispensing of glasses seem to be the major functions of military eye clinics, there are many vision problems that cannot be helped by a simple pair of glasses alone. This volume is designed to expand your knowledge of many of these very rewarding *nonspectacle* methods of detecting and treating vision problems.

1-1. Office and Home Vision Training Methods

Vision training (VT), or orthoptics, is a subject of much discussion in optometry. Usually, the discussion stage is as far as it gets. Many practitioners feel that VT is all hocus-pocus, while others claim success in everything from reading improvement to myopia reduction. It is not the intent of this volume to discuss the *pros* and *cons* of VT, but we will investigate some vision problems that may be amenable to treatment by VT, and the VT procedures that may be used in the average USAF optometry clinic.

600. Specify the development of binocular vision by arranging the steps in correct chronological order and indicate the correlation of age and vision training prognosis.

You probably have asked your optometrist questions about VT. Your questions may have included queries as to the indications for treatment and prognosis of VT patients as well as questions pertaining to procedures. This unit of instruction should answer most of your questions about VT.

Development of Binocular Vision. You are probably aware that most optometrists do not recommend VT for adults except as a postoperative orthoptic procedures. The reason is simple; you can't teach an old dog new tricks. The chance of improving major visual disturbances in adults is significantly less than the chance for improving those same disturbances in young children. This change in odds is due to the increasing difficulty of modifying an existing neuromuscular pattern in individuals whose pattern is *set*.

The development of the eyes and vision is not complete at birth but continues for some time thereafter. Several important physical changes occur in the retina and ciliary muscles for a few months after birth. Normal growth patterns also impose varying demands on extraocular muscle tonic innervation.

At birth, infants have fully functioning extraocular muscles and several functioning eye reflexes. However, the eyes are uncoordinated, and fine focusing is absent. Binocular conjugate eye movements (versions) may be observed at about 3 months of age, and fusion starts to develop at about 6 months. Accommodation and convergence are in good working order at about 1 to 1 1/2 years. Some authorities state that stereopsis is not fully developed until around age 20. Most infants are hyperopic—the degree of hyperopia varies with the investigator and may be from +4.00 D to +10.00 D. A stable refractive condition is attained at about age 20.

Since it takes time for the visual processes to develop and for the child to learn to use their vision properly, the age at which a vision defect occurs is of great importance. Neurological and muscular function is maintained only through the use of that function; and, if the use of that function is lost at a very early age and left untreated, the absence of necessary neural pathways diminishes the prognosis for successful treatment. If an infant develops a visuomotor anomaly, such as strabismus, before 1 1/2 to 2 years of age, the prognosis for eventual binocular vision is poor, but if the anomaly occurs at a later age, the prognosis improves because the child has had some experience with binocularity and just has to relearn it. The prognosis for success starts to drop again if detection is after age 6 because the proper neural channels may be *lost* and training involves not only the relearning of lost habits, but the *forgetting* of improperly learned habits.

Exercises (600):

In exercises 1–6, number the items in the order in which they are developed in a normally sighted child. Add the age at which they are observed.

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Exercises (600):

In exercises 1–6, number the items in the order in which they are developed in a normally sighted child. Add the age at which they are observed.

	Order in Which Developed	*Age at Which Observed*
1. Versions.		
2. Stereopsis.		
3. Pupillary reflexes.		
4. Fusion.		
5. Good accommodation and convergence.		
6. Stable refractive error.		

In exercises 7–10, assume that a patient has developed a visuomotor anomaly at the age in column A, and this anomaly was detected at the age shown in colum B. Write the prognosis in column C.

Column A	*Column B*	*Column C*
7. 6 months	2 years.	
8. 1 1/2 years.	4 years.	
9. 3 years.	4 years.	
10. 3 years.	7 years.	

601. Classify oculomotor anomalies as to direction and behavior and also identify the abbreviations used for oculomotor anomalies.

What came first, the chicken or the egg? A similar question may be asked; what comes first, strabismus or monocular loss of vision? Does a child become strabismic because one eye is blurry, or does the vision decrease because the eye is deviated? Let's assume that the visual anomaly is due to the muscular anomaly. This may not always be true, and a good case history should be taken to determine the etiology of the problem so that the cause and not the effect may be treated.

Definition of Oculomotor Anomalies. Although these classification anomalies assume a preexisting muscle problem, treatment usually involves training the visual and muscular defects. You have already learned the definitions of muscular anomalies. The following are definitions of oculomotor anomalies:

Orthophoria. The lines of sight intersect the object of regard when one eye is occluded or fusion is interrupted.

Heterophoria. A hidden tendency of an eye to deviate when it is occluded or fusion is interrupted.

Heterotropia. Generally, an obvious condition in which one eye fixates while the other deviates up, down, in, or out. Fusional ability is either absent or insufficient. (Abbreviations for the various tropias and phorias are shown again in table 1-1.)

Classification of Oculomotor Anomalies. Both phorias and tropias are classified according to direction, and tropias are additionally classified according to constancy, fixation behavior, and time of onset.

Constancy (concomitance). Heterotropias may be classified as concomitant or incomitant (noncomitant). A *concomitant heterotropia* is one in which the angle of deviation is the same, no matter which eye is fixating and no matter what the direction. An *incomitant* or *noncomitant heterotropia* is one in which the angle of deviation changes, depending on the eye used to fixate and the direction of gaze. In lateral phorias, the angle of deviation is the same for both eyes.

Fixation behavior. Fixation behavior may be unilateral, alternating, or intermittent. Fixation is *unilateral* when the same eye always deviates while the other eye always fixates. It is *alternating* (A) when one eye fixates part of the time while the other deviates; then the roles reverse. When the tropia is present some of the time while at other times only a phoria may be present, it is called *intermittent* ( ) fixation. *(NOTE: In any* tropia, one eye *always* fixates. An observation by many parents that both of little Johnnie's eyes cross is in error.)

Time of onset. A heterotropia may be either congenital (present at birth) or acquired (one that develops after birth).

The full descriptive classification of a heterotropia includes all of the above elements, usually abbreviated, such as *Acquired AX(T)'* (meaning "intermittent alternating exotropia at nearpoint, not present at birth").

Early detection and classification of muscular anomalies is done with the cover test, which you reviewed in volume 2.

Exercises (601):

Write the full names of the conditions abbreviated below:

1. AX(T).

2. LET'

TABLE 1–1
ABBREVIATIONS FOR MUSCULAR ANOMALIES

	phoria		tropia	
	Farpoint	Nearpoint	Farpoint	Nearpoint
eso -	E	E'	ET	ET'
exo-	X	X'	XT	XT'
hyper-	H	H'	HT	HT'
	Intermittent = ( )		Alternating = A	

3. RHT.

4. E.

5. X'.

6. You notice that a patient appears to have an LET' when looking right, but seems to be ortho when looking left. Is this a concomitant or a noncomitant heterotropia?

602. Classify visual anomalies found in cited oculomuscular disorders.

Classification of Visual Anomalies. Whichever comes first, the visual or motor signs and symptoms, oculomotor anomalies almost always have an associated visual problem. Some of these problems are:

Suppression. As previously discussed in volume 2, suppression is an attempt to *turn off* the deviating eye only while under binocular conditions to reduce the conflicting sensory input.

Amblyopia. Amblyopia (a reduction of vision in the deviating eye) is present during both binocular and monocular use of the eyes and may be due to a longstanding suppression of one eye.

Eccentric fixation. This is a defect in which, under *monocular* conditions, the image in the deviating eye does not fall on the fovea, but on an adjacent retinal area. It occurs when foveal VA is suppressed below parafoveal VA.

Anomalous retinal correspondence (ARC). In this defect, an eccentric fixator may learn to use the parafoveal area of the deviating eye as if it corresponded to the fovea in the other eye and actually fuse images while the eyes remain deviated.

Learning problems. VT is not limited to *muscle training* or acuity improvement but may sometimes be used to improve perceptual abilities. Sometimes a patient is found who can perform moderately well on most eye clinic tests but, apparently, cannot perform well in the normal visual environment. This patient may have poor attention span, poor reading ability, or a whole cluster of other learning problems. Since most of a sighted child's learning is via visual channels (about 80 percent), close cooperation between the school's special education personnel and the eye clinic may be indicated.

Focusing problems. VT is used quite often to enhance accommodative abilities in patients of all ages, and procedures of this type are moderately successful if the physiologic aspects of accommodation are not ignored (presbyopes usually aren't helped by VT because presbyopia is part of the aging process that we have no control over, thus you can't enhance or bring back that accommodation which is lost due to age).

Sometimes VT is used to change refractive errors, such as in *myopia reduction*. This aspect of VT meets with snickers from most physiologists because of the ocular anatomic changes commensurate with refractive errors. However, in their very early stages, some types of myopia and hyperopia respond to training.

Perceptual enhancement. Some VT procedures are designed to speed *visual reaction time, span of appreciation*, and *poor reading abilities*. They may work because of the *learning-by-doing* capability of the visual system.

Exercises (602):

1. You are testing a patient on the Keystone Visual Skills series. Farpoint usable acuity OD is 50 percent; OS is 96 percent. Retest on the projectochart shows: OD—20/25, OS—20/20, OU—20/20. Cover test reveals a high esophoria. Plus lens test is positive. What visual anomaly or anomalies are probably present?

2. The same patient described above *forgot* to return for treatment for a year. Findings are essentially the same, but the projectochart actuities are OD—20/40, OS—20/20, and the cover test reveals RET. What *visual* change has occured?

3. During a cover test, a patient's eyes remain steady, yet the Hirschberg (or Krimsky) test indicates LXT. VA is OD—20/20 and OS—20/80. What is the name of the probable visual anomaly?

4. The same patient described above is given the Worth 4-Dot Test. The patient describes four dots in their proper order! What name describes this?

5. Approximately what percent of a *normal* child's learning is visual in nature?

6. What is the name of the visual problem associated with diminished accommodation due to age?

603. Indicate the selection criteria for VT that may yield a high rate of success.

One of the problems associated with VT is the high failure rate due to poor selection of VT candidates. Not all patients will respond to VT alone, and many heterotropes may need surgery, both preceded and followed by orthoptics.

Selection of Patient Suitable for VT. How can the optometrist know ahead of time which patients will respond to the usual VT methods? Many criteria are available, but the ones described here are based purely on the physiology of the visual system. (These classifications are of a general nature and may not pertain to a specific case.)

Heterophorias. Adults should be selected for VT only if the symptoms warrant use of these procedures, while children may be treated even if asymptomatic.

Heterotropias. The prognosis for *training out* adult heterotropias is poor because of the extreme difficulty of changing set neuromuscular patterns and the possibility of producing a diplopia that cannot be resolved by fusion. The prognosis for children is better, especially if the heterotropia is an XT. Patient motivation is of great importance in all procedures.

Amblyopias. For physiologic reasons, most adult amblyopias do not respond to VT, but young children under six are usually responsible if well motivated.

Perceptual training. Again, this type of VT is more successful with children than adults. Specific procedures vary greatly, so ask your optometrist for more information if you are interested.

Exercises (603):

1. Ignoring the type of visuomotor defect, what qualities are the most important in choosing a VT patient?

2. Why are adults poor VT candidates?

604. Cite corrective methods that apply to in-office or home procedures designed to correct the anomalies classified under objective 601, and then cite points to observe when administering these methods.

Treatment of Motor Anomalies. The optometrist has a selection of several types of treatment for heterophorias and heterotropias, depending on the severity of the phoria or tropia and its relation to the patient's visual environment and complaint, as well as the avilability of facilities. In many cases, nothing may need to be done except for patients with extreme deviations. The following is an outline of available treatment choices.

General visual training (VT) procedures. There are literally hundreds of visual training procedures. We will present five of the basic training procedures. If you understand these procedures, you will find little difficulty comprehending the principles of other techniques.

(1) Rotations or pursuit movements. The ability to place and maintain a retinal image of an object on the fovea depends on the ability to act on feedback information to recenter the image on the fovea whenever it departs. The rotator helps to produce precise, smooth, circular movements of the eyes, and it is designed also to help break down suppression. The patient should be seated in front of the rotator and properly centered. Have the patient fixate the rotator target, turn on the instrument, and observe the patient's eye movements as they follow the target. Proceed for 3 to 5 minutes on each eye. The training may also be given binocularly when indicated. The eye(s) should be trained to follow the target smoothly at a slow speed, and then at somewhat more rapid speeds. Watch for any dizziness or inattentiveness on the part of the patient. Allow a few minutes rest between each procedure. Record the nature of the eye movements (for example, smooth, jerky, etc.) noted monocularly and binocularly and keep a record of any progress.

(2) Copying exercises. This type of procedure is used to augment other procedures used in the treatment of amblyopia ex anopsia. There are many variations including coloring of pictures, completing numbered dots to create a diagram-picture, and simple tracing. These procedures may include wearing a patch or anaglyph glasses. An effective way to keep apictorial record of patient progress over a period of time is to have him or her trace a line maze and retain it for later comparisons. Procedure: The patient's good eye is patched for several weeks. In conjunction with this and other procedures used in the treatment of amblyopia, simply have the patient trace a line maze. The degree of success or progress in tracing the maze with the amblyopic eye will be evident and can be incorporated into the patient's record. Progress can also be compared to tracings made with the nonamblyopic eye.

(3) Duction training to increase fusional ability in most patients. For our purposes, horizontal duction simply means the convergence or divergence of the two eyes to maintain fusion through horizontal prisms of increasing power while viewing a target located at a specific distance. The ability to keep from seeing double under those conditions is related to your fusional reserve; this is, your capacity to maintain fusion. (It is also possible to produce vertical ductions by use of vertical prisms, but we will confine our discussions in this course to the horizontal, or lateral, ductions.) Almost any instrument with rotating prisms can be used for duction training measurement. Set the prisms to zero and have the patient fixate on the target. Turn the base-in prisms until the patient notes a blur of the target, or diplopia. Note the prism value at which blur or diplopia occurs. Return the prisms

slowly to zero and then repeat the above procedure slowly several times in an attempt to increase the prism value at which blur or diplopia occurs. Base-in prism training, as described here, forces divergence while maintaining a fixed level of accommodation. The goal is to increase the *abductive* ability of the eyes. For base-out training, the procedure is the same as above except that base-out prism is applied. Base-out training increases the *adductive* ability of the eyes. During either base-out or base-in training, it should be noted that if suppression occurs, the patient will see only a lateral movement of the target, and the training becomes invalid.

(4) Accommodative rock. As you know, accommodation of sufficient amplitude is essential for most patients to maintain clear, comfortable vision at the near point. If a young patient (this excludes prepresbyopes and presbyopes) who is otherwise healthy, has a low amplitude of accommodation for his or her age, it may be appropriate to institute training aimed at improving that patient's accommodation. Listed below are three methods of administering training of this type:

- Keystone telebinocular. Add minus lenses in progressive steps monocularly, and use alternate occlusion. Record the amount of minus the patient is able to clear.
- Trial frame. Add minus lenses, as in the telebinocular method with alternate occlusion. Again, record the amount of minus cleared by patient.
- Slit occluder. The slit occluder is a simple, inexpensive home-training device to maintain training outside the office (fig. 1-1). The patient fixates through the low portion at 20/20 print for 30 seconds; then views through the top portion at a distant object until clear. The patient alternates this procedure several times; then reverses the card for the opposite eye.

(5) Brock string. The Brock string is a nearpoint procedure for exodeviations using household string. This basic procedure can be used to make the patient aware of suppression as you try to help him or her elicit binocular vision. Place a knot in the string about 8 inches from one end. Have the patient hold that end of the string at arm's length and the other end to his or her nose. Then direct the patient to fixate the distant end. If there is no suppression, the patient will see the string as two strings in the form of a V with the apex of the V meeting at the distant end. If only one string or one leg of a V is seen, then suppression is occurring. Try to break the suppression by alternate occlusion. If successful, have the patient fixate the knot. If there is no suppression, an X should be observed. If there is suppression, the patient will observe only one string or possibly a Y configuration. Continue the alternate fixation for 5 minutes or so, using alternate occlusion, as described above, in an attempt to break down the suppression, if any. Record the results of the initial test for suppression and the progress, if any, after completion of the entire procedure. Periodically retie the knot at points closer to the nose.

Esophoria. Listed below are procedures to follow in the treatment of esophoria:

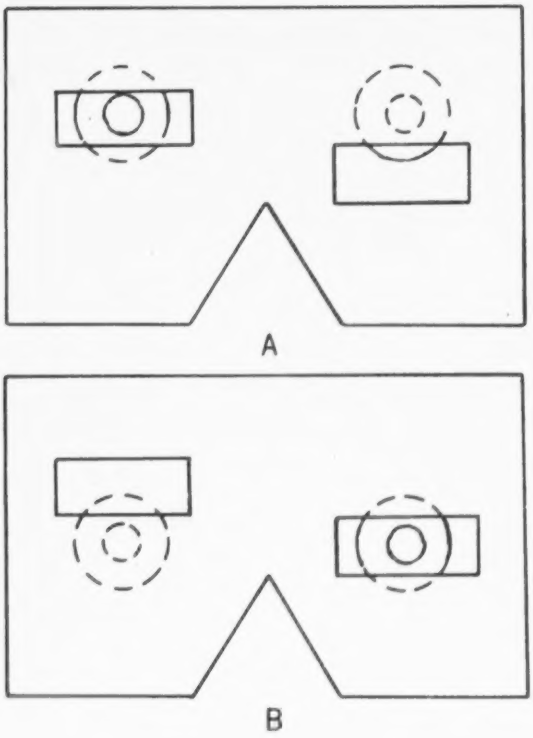


Figure 1-1. The slit occluder.
A. Viewing distant objects
B. Viewing near objects

(1) Correction of refractive error using maximum plus lenses and bifocals.

(2) Use of base-out (BO) prisms to compensate for (not correct) the deviation. (BO prism may increase the underlying esophoria.)

(3) Orthoptic (visual training) procedures including divergence exercises with prism (base-in prism), and divergence exercises using movable targets on the Keystone Stereoscope or a similar device.

(4) Occasional use of miotic drugs.

(5) Rare use of surgery.

Office procedures should be done weekly, for about 30 minutes a session. Home procedures should be done for several minutes a day, several times a day. Prognosis is poorer than for exophoria, probably because of the absence of a cerebral divergence center.

Exophoria. Procedures for the treatment of exophoria are as follows:

(1) Correction of refractive error using maximum minus lenses to stimulate accommodation and accommodative convergence.

(2) Use of base-in prisms to compensate for the deviation. Remember, compensating prism is not recommended for many phorias because it does not correct the basic problem or strengthen the eyes.

(3) Orthoptic (visual training) procedures including convergence exercises, such as "pencil pushups" (patient

observes a target while moving it closer to his or her eyes) and Brock string.

(4) Rare use of surgery.

Variable base-out prisms may be used in the clinic to stimulate convergence. Again, a suppression check must be used. The Keystone telebinocular also has a series of targets for BO fusional convergence. Daily time allowed for training is about the same as that for esophores.

Hyperphoria. The following are procedures for the treatment of hyperphoria:

(1) Full correction of refractive error and possible vertical decentration of lenses.

(2) Prism, if the deviation is comitant and less than about 10^{Δ}. Usually, the minimum prism that will allow fusion is prescribed, and this prism is *split* between the eyes.

(3) Surgery if the deviation is great.

(4) Vision training is usually unsuccessful.

Comitant congenital ET. Treatment for comitant congenital ET is as follows:

(1) VT for reduction of amblyopia. Amblyopia VT procedures include patching the *good* eye, using anaglyph glasses and special reading targets, pleoptics (dazzling the extrafoveal area of the *bad* eye with light), and various other procedures.

(2) Surgery.

Comitant acquired ET. Comitant acquired ET is treated as follows:

(1) Correction of refractive error with maximum plus lenses and correction of any aniseikonia that may be present.

(2) Fusion training.

(3) Amblyopia training for nonalternators.

(4) Probably surgery with both prior and subsequent VT.

Prognosis is better than for congenital ET, but poorer than for XT. Orthoptic procedures are similar to those used for E, but use grosser targets and start by teaching the patient to recognize diplopia in an attempt to break down suppression and amblyopia. The surgery is intended to provide both a good cosmetic result and a basis for training the patient to become first an esophore and then an orthophore.

Accommodative ET. Following is a list of steps used in the treatment of accommodative ET:

(1) Correction of refractive error with maximum plus lenses as found by a cycloplegic refraction.

(2) VT to eliminate suppression and amblyopia.

Accommodative ET is usually found at about age 3 as an AE(T) or AE(T)' when the child tries to focus on an object. The ET later becomes constant. Plus lenses and bifocals work wonders.

Intermittent ET. E(T) in the absence of hyperopia may respond to orthoptics but usually requires surgery.

Exotropia. Exotropia is treated as follows:

(1) Correction of refractive error as in X.

(2) Surgery if deviation is greater than about 10^{Δ}.

(3) Orthopics, both pre- and post-operatively. Procedures are similar to those for X.

Hypertropia. Hypertropia is treated as follows:

(1) Prism for small deviations.

(2) Surgery for large deviations.

Exercises (604):

Complete exercises 1-5 below by indicating the things you should look for when administering specific VT procedures.

1. Rotations.

2. Copying exercises.

3. Duction training.

4. Accommodative rock.

5. Brock string.

In exercises 6-11, state the type of VT usually prescribed for each specific visual problem listed.

6. Esophore.

7. Exophore.

8. Hyperphore.

9. Exotrope.

10. Esotrope.

11. Hypertrope.

12. What category of patients will not benefit from accommodation training?

13. What should you record when using the telebinocular to exercise accommodation?

605. Cite facts concerning the general methods of increasing accommodative abilility.

A very common complaint in the clinic involves the patient's observation of a blur when focusing from far to near or from near to far. Done correctly, VT may improve accommodative power noticeably.

Treatment of Accommodative Problems. Although many people use the terms "vision training" and "orthoptics" interchangeably, they really arent synonymous. Orthoptics pertains to muscle training and is only a part of vision training that may include development of other visual abilities, such as accommodation.

You have probably seen some prepresbyopic patients with a complaint of nearpoint blurring after a short period of reading. Accommodative tests may be WNL (within normal limits) or only slightly below expected. These patinets may be unable to sustain accommodation for any length of time, and may need VT in the form of accommodative exercises. Another patient may complain of blurry vision when focusing from a distant object to a near object, or vice versa. This loss of accommodation may be reduced by appropriate VT.

Two accommodative exercises are available, even for clinics with minimal equipment. The first method involves the use of minus power for reading. The patient focuses without lenses on a farpoint object, then looks at a nearpoint object either monocularly or binocularly through minus lenses. Stronger minus lenses are used as the patient adapts to the training lenses. Unless your clinic has an excess of minus trial case lenses, don't recommend this as a home-training procedure.

A good home-training type of accommodative rock procedure uses an occluder similar to that in figure 1-1. The patient holds the occluder (usually made from a 3 x 5 card) up to his or her face in such a manner that the right eye is occluded. The patient focuses on the nearpoint target until it is quite clear, then looks up again to the farpoint target. After repeating the procedure several times, the patient reverses the card so that the left eye is used for distance vision and the right eye is used for near. Total training time should be about 5 to 7 minutes per session, with as many sessions as possible throughout the day.

Exercises (605):

1. What materials are needed for a simple home-training device to improve accommodation?

2. Why should you not recommend the trail frame training as a home procedure?

1-2. Tonometry

Tonometry is the measurement of the pressure exerted by the fluids inside the eye. This fluid pressure maintains the eye's shape. The procedure can be related to checking the tire pressure of your car. Too much, as well as too little, pressure could be damaging. Just as the correct range of pressure varies with the type of car you drive, so does the normal range for eye pressure vary with the individual.

606. State the purpose of tonometry and specify the physiology of glaucoma.

Purposes of Tonometry. There are two basic reasons why you perform tonometric measurements on patients in your clinic. These are:

(1) To establish a baseline level in patients who have a familial history of glaucoma (GLC).

(2) To screen patients in order to detect glaucoma in its early stages.

Approximately 3 percent of the population of the USA has glaucoma, which is a disease characterized by an elevation of the IOP (intraocular pressure) with resultant damage to the cells and tissues of the eye. Many victims are unaware that they have this disease, and it may remain undetected until the pathologic ocular changes are irreversible.

Glaucoma may be generally classified into *chronic* and *acute* types. The chronic type has a gradual onset, and the acute type is associated with a more sudden onset. An extreme form of acute GLC is the acute glaucomatous crisis, in which the IOP drastically elevates in only a few hours.

Glaucoma may also be divided into *primary* and *secondary* types. A primary glaucoma is one that is not associated with other ocular diseases. Primary GLC may be subdivided into: (1) adult primary glaucoma, (2) juvenile or congenital primary glaucoma.

Adult primary glaucomas may be further subdivided into:

a. Open- (chronic simple) angle glaucoma. This is the most common type of glaucoma. The anterior chamber appears normally deep, and the patient may be asymptomatic. This type affects both men and women equally and is more prevalent in presbyopes.

b. Closed- (or narrow) angle glaucoma. Patients with this form of the disease have shallow anterior chambers, and other symptoms may appear rapidly. More women than men contract this type, and the victims are usually not myopes. The predisposition to this disease appears to be genetic and usually occurs after age 40.

Juvenile glaucomas are usually congenital and are transmitted as a dominant characteristic (the disease usually affects every generation).

Secondary glaucomas are due to the presence of other ocular conditions, usually some ocular injury or disease.

One of your duties is to measure of the IOP of optometry clinic patients in order to aid in the early detection and diagnosis of GLC. In order to perform this duty properly, you should know not only what glaucoma is, but you should also know a little about the physiology of the eye as it pertains to GLC.

Physiology. You know that the eye is basically a hollow organ composed of three tunics that enclose fluid called aqueous humor and vitreous humor. For this discussion, we are primarily concerned with the aqueous humor.

Aqueous humor is continuously formed at the ciliary processes, in the posterior chamber, and flows into the anterior chamber via the pupil. It then drains from the eye through the Canal of Schlemm. As long as aqueous production and outflow remain constant, IOP is normal and the eye functions well. When aqueous production increases, or its outflow decreases (which is more likely), and IOP rises enough to destroy retinal tissue, an individual is said to have glaucoma. In Volume 2, you leaned that the lamina cribrosa is a thin, perforated portion of the sclera through which the optic nerve and retinal blood vessels enter the eye. This is the weakest point in the eyeball. As IOP increases, tissue at the optic nerve head is destroyed and the optic disk enlarges and becomes cupped. In addition, the increased pressure restricts blood flow in the retinal vessels and the peripheral retinal cells are destroyed because of the lack of oxygen.

Some researchers have found that 15 to 20 percent of glaucomatous patients have a familial history of GLC, which emphasizes the need for a good case history. This fact, combined with your knowledge that GLC usually affects middle-aged adults, makes the establishment of a baseline IOP at an early age imperative; otherwise you might miss the onset of a gradual increase in IOP or misinterpret a normally high IOP as an abnormal reading. Normal and abnormal values will be given later in this unit, but for now it is sufficient to say that some people have a *normal* IOP that would destroy ocular tissues in others. You should measure the IOP of every patient with a familial history of GLC at the earliest reasonable opportunity, and at each annual or semiannual visit.

Exercises (606):

1. What is the purpose of tonometry?

2. Which sex and age group is most susceptable to closed-angle glaucoma?

3. How is the aqueous humor produced and how is it drained?

4. What are two causes for increased IOP?

5. Which type of glaucoma is more prevalent in hyperopes?

6. Which type of glaucoma is asymptomatic?

7. In which chamber is aqueous humor formed?

8. When are baseline level IOP's best established?

607. Specify characteristic symptoms of patients with glaucoma.

Indications for Tonometry. Just when should you measure somebody's IOP? Well, there are several guidelines:

- When requested by your optometrist or a referring physician.
- On any patient 39 years of age or older.
- On any patient with a personal or familial history of GLC.
- On any patient experiencing symptoms of GLC, and when authorized by an OD or MD.

Symptoms of glaucoma. Many patients enter the clinic with symptoms of headache and blurred vision or with complaints of red, irritated eyes. Some of these patients may mention their fear of having glaucoma. The following section is designed to indicate the major symptoms of glaucoma and to differentiate these signs and symptoms from diseases that may evidence similar signs and symptoms, such a iritis or conjunctivitis. The most common symptoms of glaucoma are:

a. Pain in and around the eye. Usually more intense just after awakening or in a dark room.

b. Halos or colored fringes around lights.

c. Blurry vision, usually but not always at nearpoint.

d. Loss of peripheral fields.

e. Poor night vision (due to constriction of peripheral fields and loss of rod function.)

f. Redness and tearing of the eyes.

Table 1-2 shows some of the differences among the signs and symptoms of glaucoma, conjunctivities, and iritis. Although you are not permitted to make a diagnosis of these diseases, you may use this information in explaining the symptoms of GLC to your patients. Let's investigate some of these signs and symptoms a little more thoroughly.

TABLE 1-2
DIFFERENT SIGNS AND SYMPTOMS OF GLAUCOMA, CONJUNCTIVITIS, IRITIS

	Glaucoma	*Conjunctivitis*	*Iritis*
Patient's Age	Over 40	All ages	Under 45
Pain	Severe	Slight	Moderate
V.A.	Varies	No change	Slight loss
Injection	All types	Superficial	Limbal
Pupils	Mydriatic	No change	Miotic
	Oval (axis 90°)	No change	Irregular
Anterior Chamber	Shallow	Normal	Normal
Cornea	Steamy	No change	K.P.s
	Decreased sensitivity	No change	No change
Discharge	None	Mucous	None
IOP	Elevated	No change	W.N.L.
Visual Fields	Field loss	W.N.L.	W.N.L.

(1) Visual acuity in a glaucomatous patient may be reduced because of corneal edea and possible loss of function of the accommodative mechanism.

(2) Pain is quite severe as the disease progresses. The pain is greater in the morning (upon awakening) because of the diurnal IOP increase at this time.

(3) Vascular injection is marked (the patient's eyes are really bloodshot). Both the conjunctival and scleral blood vessels are engorged.

(4) Because of the paralysis of the ciliary body, the pupil of the glaucomatous eye appears dilated, and often appears as a vertical oval.

(5) The optic disk in a glaucomatous eye shows increased cupping because of the increased pressure.

(6) Halos may be seen by the glaucomatous patient caused by light diffraction by the edematous cornea.

(7) Visual fields are most important as a diagnostic device. Techniques and typical fields will be covered in a later unit.

Regulation involving tonometry. Medical regulations recommend that tonometries be performed on all patients 39 years of age or older during their annual physicals. This is a good practice to extend to your nonmilitary patients during their routine eye exams.

Tonometry is not recommended for patients with conjunctivitis because of contaminating the instrument and spreading the disease to other patients. If you must perform a tonometry on a patient with conjuctivitis, either use a Tonofilm or adequately sterilize the tonometer immediately after use, or both.

Exercises (607):

Indicate whether the following statements are true or false by circling T or F as appropriate. Explain the false statements.

T F 1. Only adults get glaucoma.

T F 2. Symptoms of glaucoma are always the same and mean nothing else.

T F 3. Early morning headaches may be a symptom of glaucoma.

T F 4. Patients with glaucoma see halos around light because of retinal changes.

608. Given a list of types of tonometers and a list of descriptions of the tonometers, associate each tonometer with its correct description.

Instrumentation. There are several types of clinical instruments used to determine intraocular pressure. One is the Schiotz tonometer which is used in some USAF medical installations. Other types include applanation electonic and noncontact tonometers.

The Schiotz tonometer. This is a relatively simple instrument, used with little change from its invention in 1905. Some USAF clinics may still be using one of these. The Schiotz is used primarily for screening.

Construction of the Schiotz tonometer is shown in figure 1-2. The instrument consists of a footplate with a concavity whose curvature approximates that of the cornea, a plunger sleeve, and attached calibrated scale and pointer, a movable handle, and a plunger assembly with loading weights. A calibration block is also supplied with each instrument, as well as a conversion table to change instrument reading to millimeters of mercury (mm Hg) of pressure.

The instrument works on the principle that a weight applied to the eye will indent the eye, and the amount of indentation is inversely proportional to the pressure inside the eye. You use the same principle when you try to poke your finger into a partially filled balloon and note that it is easier than when you try to poke your finger into a completely filled balloon. The weight or force applied to the eye is the combined weight of the plunger and loading weights. When the bottom of the plunger is flush with the surface of the footplate, the indicator needle should point to zero. When the plunger drops below the footplate (as it does when it indents the cornea), the indicator needle reads to the right of zero.

The assumption that IOP influences the indentability of the eye is true, but there are other variables that can influence the Schiotz reading. One of these variables is the weight on the plunger. Each individual instrument is calibrated so that the plunger *combined* with the weight marked "5.5" weight 5.5 grams. The 5.5-gm weights are *not* interchangeable among instruments. They are calibrated only for the instrument with which they are packed. The effective force on the plunger may also be changed by allowing a residue to build up in the plunger sleeve, thus increasing friction. The effective force may also be changed if you hold the instrument on an angle more than a few degrees from vertical.

Another variable is the flexibility of the cornea. It is easier to indent a rubber balloon than to indent a basketball because of the difference in flexibility between the materials used in each (we'll assume the pressures are equal). Some eyes behave in a similar manner.

A third variable is pressure on the eye from extraneous sources, such as nervous intraocular muscles or a nervous examiner's thumb. Keep your thumbs out of the patient's eyes!

The proper method of using a Schoitz tonometer includes these steps:

(1) Periodically check your instrument on the calibration block supplied with the tonometer. If the needle does not point to zero, don't calibrate the thing by bending the needle; instead, loosen the setscrew in the plunger sleeve and rotate the footplate until the needle again points to zero. Tighten the setscrew when you are finished.

(2) Sterilize the instrument. You may use a heat or ultraviolet sterilizer, or a solution of 1/5000 benzalkonium (Zephiran) chloride (do NOT use the 1/1000 solution normally available). Some clinics use alcohol or ether, but

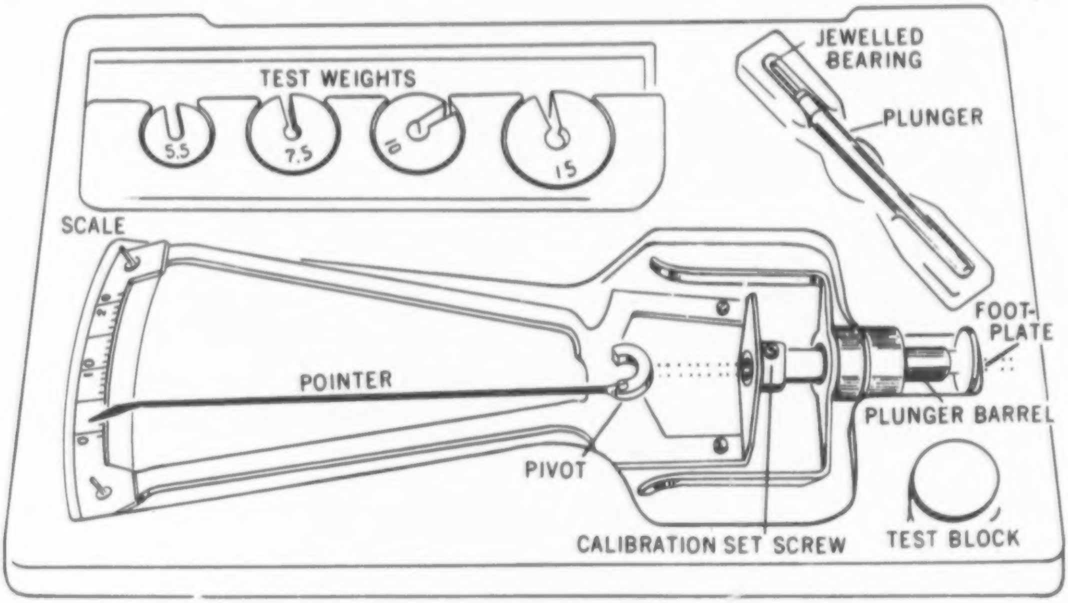


Figure 1-2. The Schiotz tonometer.

there have been cases of corneal burns caused by these solvents dripping down the plunger shaft. Complete sterilization should include a mechanical cleaning with a pipe cleaner and cotton swab to remove any foreign material from the plunger shaft and footplate. This may be done by removing the 5.5-gm weight, sliding out the plunger (don't drop it), and running the pipe cleaner up and down the plunger shaft. Use the cotton swab to wipe the footplate and plunger clean. Alcohol may be used for this cleaning process, but make sure that it has evaporated before you use the instrument. Resterilize the tonometer after cleaning.

(3) Prepare the patient. Ideally, the patient should be lying down in the face-up position on a firm surface. The patient's neck should not be hyperextended, and the patient's collar should be loosened. Have the patient fixate a spot on the ceiling directly above the eye to be tested, or have the patient fixate his or her thumb while holding it at arm's length above his or her face. The patient should keep both eyes open during the test procedure. Ask the patient if he or she has any allergy or sensitivity to drugs. If so, determine the drugs to which the patient are allergic or sensitive. If the patient has a sensitivity to anesthetics similar to dental anesthetics, check with the pharmacy to determine which drug you may use. If the patient has no know drug sensitivities, place a drop or two of ocular anesthetic (ophthetic) in each eye and wait a few seconds for the drops to work. Explain to the patient what you are doing, but don't let the patient see the tonometer until you place it on his or her eye. Remind your patients that they will feel no discomfort as long as they relax and keep both eyes open.

(4) Hold the patient's lids apart while you apply the tonometer to the cornea. Remember not to block the view of the fixation spot, and remember not to apply pressure to the globe with your fingers. Rest the tonometer on the anesthetized right cornea for a few seconds and observe the indicator needle. If you see very small fluctuations, you are doing a good job, since these fluctuations are due to the patient's pulse. Remove the tonometer and record the scale reading. Repeat for the left eye.

(5) If the scale reading on either eye is 4 or less, repeat the test with the 7.5-gm weight.

(6) Convert the scale reading to pressure in mm Hg by using the scale in the instrument case. Record this pressure on the appropriate exam form, noting both the value in mm Hg and the weight used.

(7) Remind your patients not to rub their eyes for at least one-half hour after the exam, because they may injure the anesthetized cornea.

Applanation tonometers. Another method of tonometry that is gaining popularity in the USAF is the applanation method. This method is based on the principle that a given force will flatten an eye an amount inversely proportional to the IOP, that is, a given weight will flatten a soft eye over a larger area than a hard eye. Similarly, if the area of flattening is held constant, it would take a lighter weight to flatten a soft eye than a hard one. A topical anesthetic is needed for this instrument.

At first glance, the differences between indentation and applanation tonometry may seem insignificant, but in actuality, these slight differences are quite important. Since the force used in applanation tonometry is less than that used in indentation tonometry, less fluid is displaced within the eye, and therefore ocular tunic flexibility has a lesser influence on the readings. Similarly, the applanation method bends the cornea less than indentation methods, and the readings are more directly related to the IOP. The lesser pressure also reduces the chance of corneal abrasions.

The Maklakov tonometer used in Russia is an applanation type. The tonometer, along with the Tonomat and Applanometer, is occasionally used in the USAF ophthalmology clinics. The Goldmann tonometer, used by many ophthalmologists, is also an applanation type. You may have seen a Goldmann tonometer mounted on a slit lamp in an optometrist's or ophthalmologist's office. Procedure with this instrument involves the placement of a probe upon the patient's anesthetized cornea with the aid of a joy stick on the slit lamp. The examiner observes the contact area of the probe against the cornea by looking through the slip lamp and a rangefinder (image splitter). The area of contact is made more visible with flourescein dye. The pressure necessary to flatten an area of the cornea 3.06 mm in diameter is read from a dial on the instrument. This pressure is equivalent to the IOP.

AO noncontact tonometer (NCT). In the last few years this instrument has become the most widely used tonometer in the USAF. It is more expensive than the Schiotz but much more acceptable to the patient, technician, doctor, and clinic operation. The key factors are that the patient is not touched by the instrument, therefore, no anesthetic is needed. Other advantages are that the test can be performed before the doctor's examination as part of your preliminary work up, no special room is needed, and the reading does not have to be translated from another long list of numbers and weight factors. Also, the instrument is very easy to operate, yet, it is extremely sophisticated. This instrument is ideal for establishing baseline level glaucoma reading even on small children with indicating family histories.

How does this advancement in technology work? this tonometer, shown in fig. 1-3, shoots a gentle puff of air at the eye, and computes the time it takes the air pulse to flatten the cornea. The way the tonometer knows when time is up is by light sensors; one located on each side of the air nozzle. These sensors pick up the edge of the light reflection as soon as the cornea is flattened enough. This time is converted into mm Hg, representing the intraocular pressure. A digital reading is instantly displayed for you. The proper method of using the NCT is as follows:

a. Preparation of instrument.

(1) Turn it on. The digital readout will indicate either 68 ±1 on NCT I and 65 on NCT II. This number ensures you that the instrument is on.

(2) Allow 30 seconds for warmup.

(3) Remove protective cap from air nozzle.

b. Patient preparation.

(1) Seat the patient opposite yourself facing the machine.

(2) Explain what you are about to do and give the patient a demonstration puff. This is done by having the patient

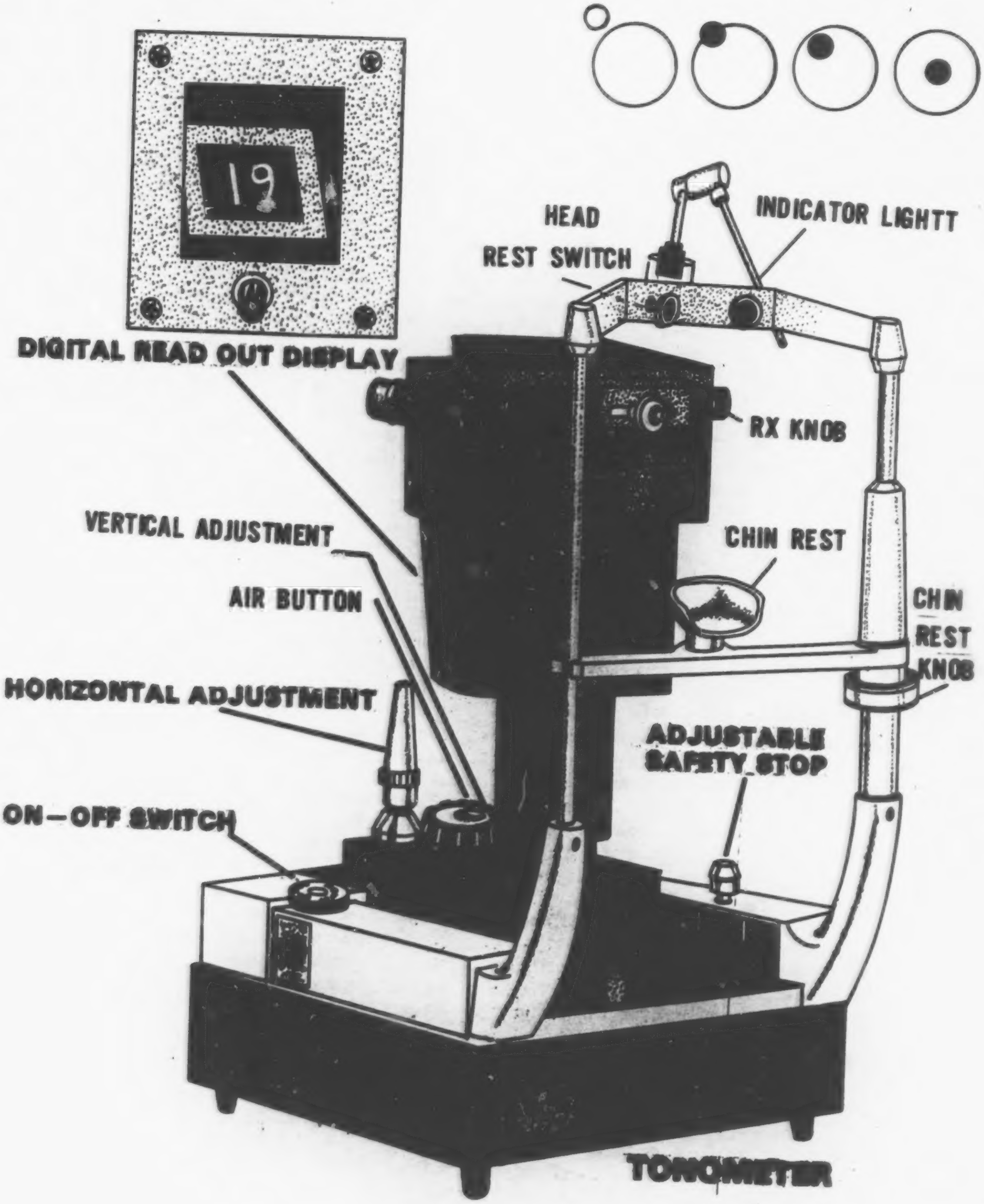

DIGITAL READ OUT DISPLAY
19
HEAD
REST SWITCH
INDICATOR LIGHTT
RX KNOB
VERTICAL ADJUSTMENT
CHIN REST
AIR BUTTON
CHIN
REST
KNOB
HORIZONTAL ADJUSTMENT
ADJUSTABLE
SAFETY STOP
ON—OFF SWITCH
TONOMETER

Figure 1–3. Noncontact tonometer.

hold a finger about 1/4 inch from the air nozzle. Put the instrument on demonstration and depress the air release button. The digital readout will show 57 ±1 for NCT I or 50 ±1 on NCT II, provided calibration is proper.

(3) Return instrument to ON position.

(4) Have patient remove glasses.

(5) Have patient place chin on chinrest; adjust height so that the lateral canthus is same as the proper height mark on instrument.

(6) The patient's forehead should be placed firmly against the forehead pads. The left forehead pad, when pressed on, lights up the inside of the instrument better. (CAUTION: Do not allow the patient to hold onto the instrument when administering this test. The reason is that even though the air puff is gentle, it does startle some patients and the patient may pull the instrument over.)

c. Administer test.

(1) Position air nozzle directly in front of the patient's cornea. Use the elevation control and the joy stick for lateral movements. By watching the patient's cornea, you'll see a reflection of a circle. This will indicate you're lined up in front.

(2) Ask the patient to close both eyes. Lift the stop lock knob and position the air nozzle about 1/4 inch from the patient's eyelid. Let the knob reset to lock the stop in that place. This keeps the instrument from getting any closer to the patient's eye, though you can still back the instrument up for focusing purposes.

(3) Ask the patient to open both eyes and continue to look directly into the air nozzle at the red dot. There is an Rx knob you can adjust if the dots are not clear to the patient.

(4) You will look into your eyepiece and adjust it, just like on the lensometer, until the black circle is clear and sharp.

(5) Using the elevation control and the joy stick, track the red dot you see until it is inside the black ring. At that instant, depress the air release button. If the signal level indicator (red light) in front of joy stick comes on or the digital on NCT II does not flash, your reading can be considered valid.

Step 5 often times will be a little frustrating, because each slight movement of the patient's eye will cause you to readjust the focus of the red dot that you are trying to get inside the black ring. With some practice and experience you'll be able to perform this test on the NCT in much less time than with the Schiotz.

During your testing, you may press the air release button and your readout will indicate 99. This means you missed by hitting an eyelash, usually. Just try again.

Normally, you would take two readings from each eye but especially if you get a difference of 3 or more in the same eye. Usually, the readings will fall between 10 mm Hg and 21 mm Hg. Remember, though, each individual is different and what appears to be normal for one patient may be abnormal for another. You are obtaining information for your doctor to interpret and incorporate into the examination and only then can a condition of abnormal be determined. In some situations, further testing on other instruments will be required to make that determination. We'll discuss them later.

Electronic tonometry. Another type of tonometer is the electronic tonometer. This instrument is based on the principle that the pressure needed to move a small plunger less than 5 microns is related to the IOP. The movement of the plunger is measured by a sensitive electronic amplifier and transcribed on a moving roll of paper. The footplate around the plunger apparently negates the bending forces of the cornea. Electronic tonometers are sometimes classified as applanation types.

Since there are relatively few Goldmann, applanation, or electronic tonometers in optometry clinics, test procedures for these instruments will not be explained here. If your clinic has one of these instruments, have your doctor explain its proper use.

Exercises (608):

1. Match the items in column B with the proper items in column A. Each item in column B may be used more than once.

Column A

____ (1) Tonometer most commonly found in USAF optometry clinics.

____ (2) Tonometer that uses fluorescein.

____ (3) Based on the indentation of the cornea.

____ (4) Based on the flattening of the cornea.

____ (5) Instrument that makes its own permanent record.

____ (6) Patient remains seated during this procedure.

____ (7) Corneal flexibility may cause significant errors.

____ (8) Used with a slit lamp.

____ (9) Does not require an anesthetic.

Column B

a. Schiotz.
b. Goldmann.
c. Electronic.
d. AO noncontact.

609. State tonometry test results.

Interpretation of Test Results. Tonometric measures in the optometry clinic are considered more or less screening tests, since any patient whose IOP falls above a certain criterion will be referred to the ophthalmology clinic. The criteria for referral are as follows:

- Two or more measurements of 22 mm Hg or higher.
- One or more measurements of 25 mm Hg or higher.
- A difference of more than 4 mm Hg between eyes.

What happens if a patient's IOP falls within the referral criteria? The presence of elevated IOP alone does not necessarily mean the patient has glaucoma; further tests must be performed. If you work in a combined ophthalmology-optometry clinic, you may be required to assist in the tests described below.

Water provocative test (Schiotz). The patient is required to abstain from food and drink for 12 hours before the test. Upon arrival at the clinic, the patient's IOP is measured, then the patient is asked to drink 1 liter of water within a few minutes. IOP is measured every 10 to 15 minutes for an hour. If the IOP elevates 5 mm Hg, there is a possibility of GLC. If the IOP elevates 7 mm Hg or more, there is a high probability of chronic simple GLC.

Dark-room provocative test. Any dilation of the pupil will cause a constriction of the Canal of Schlemm, thereby reducing aqueous drainage. If a patient has a closed-angle type of glaucoma and is placed in a dark room for an hour, the IOP will rise from 7 to 10 mm Hg.

Measurement of visual fields. The final determination of the presence of ocular nerve or retinal damage due to elevated IOP is the measurement of peripheral and central visual fields. Glaucoma causes specific and typical field changes, and these changes will be covered in the next unit.

Exercises (609):

1. Where would a patient be referred if glaucoma is suspected?

2. What is the criteria for suspecting glaucoma?

3. If a patient is suspected of having chronic simple glaucoma, at what rate did the IOP elevate and which test was conducted?

4. If a patient is suspected of having closed-angle glaucoma, what was the rate of elevation and which test provided this information?

1-3. Investigation of the Visual Fields

Most people take their vision for granted. They assume not only that they can see clearly but also that they can see everything that's going on in front of their eyes. Most people are unaware of the physiological blind spot in each of their eyes and may be even less aware of any pathological blind areas. This section is designed to improve your knowledge of the anatomy of the neurological portion of the visual system and to expand your capability of performing visual field tests.

610. Trace the pathway for the visual reflex from the retina to the visual cortex.

Anatomy of the Visual Pathway. The retina is an extension of the brain, and any damage to retinal (or brain) nerves cannot be repaired. Neurological damage in retinal or brain areas is permanent. Injuries (or lesions) can occur anywhere in the visual system, and the location of these lesions can be pinned down fairly accurately by determining the type and location of the resultant visual field loss. Visual field examinations are also useful in determining the location of brain lesions near the visual pathway because these lesions may affect the visual pathway. Figure 1-4 shows the anatomy of the visual pathway from the retina to the occipital lobes or vision portion of the brain. Light strikes the retina and is converted into electrical impulses (probably by a type of enzyme reaction) that eventually leave the retina via the optic nerve. Fibers from the nasal retinas cross at the optic chiasm, while fibers from the temporal retinas continue straight back into the brain. The visual pathway after the optic nerve is called the *optic tract*. Fibers from the optic tracts synapse in the lateral geniculate body (LGB) where the pupillary reflex fibers shunt off to another portion of the brain. Visual fibers continue backwards as the optic radiations, which end in the visual cortex located in the occipital lobes (Broadmann's areas 17, 18, and 19).

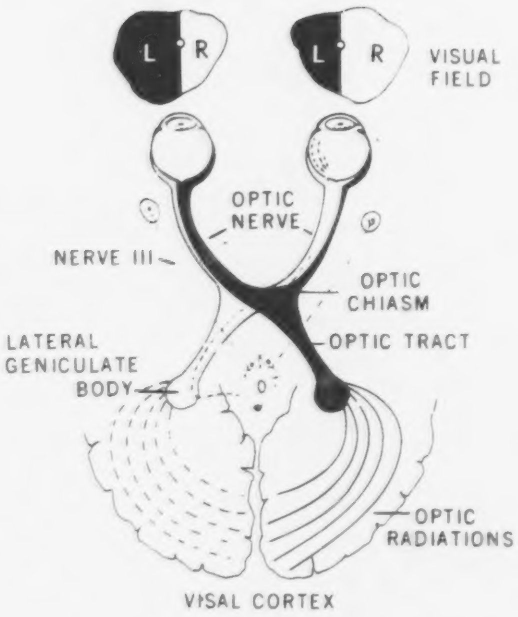


Figure 1-4. The visual pathway.

Any lesion in or near any of the seven areas described above produces a defect in the visual field, and the shape and type of defect (scotoma) depend on the location of the lesion. Individuals with a thorough knowledge of the anatomy of the visual pathway and with a suitable plot of the visual field defect can closely approximate the location of the brain lesion.

Exercises (610):

1. List in order, from the receptors to the cerebral visual centers, seven significant neural structures of the visual system and describe each.

611. Identify the major visual field defects.

Any injury, disease, or other lesion occurring in or near the visual pathway will cause some type of visual field loss. These visual field losses may be classified into three general headings and may occur either singly or in combination with each other. You should know the names and characteristics of these losses so you can properly describe them to your optometrist.

Classification of Visual Field Defects. Visual field defects are called *scotomas, depressions*, and *contractions*.

Scotomas. Scotomas (areas of blindness surrounded by an area of normal vision) are either positive or negative, depending on the location of the causative lesion. A positive scotoma is an area of blindness of which the patient is aware, usually perceived as a black spot and is on the retina. A negative scotoma is one of which the patient is not aware, located somewhere behind the retina. The physiological scotoma (normal blind spot) in each eye is an example of a negative scotoma and the only retinal negative scotoma.

Depressions. Depressions (or relative scotomas) are probably the most common visual field defects. A depression represent an area of lowered visual acuity, located either centrally or peripherally. A depression can take any shape, and its margins are usually sloping; that is, they have no sharp borders.

Contractions. Contractions are relatively rare field defects. A contraction represents a totally blind area with steep margins (margins with sharp borders or margins that present the same isopter no matter how large the target). Contractions are usually peripheral, as in a detached retina.

Exercises (611):

1. List, in outline form, the three major visual field defects, describing each.

2. What kind of scomatoma is the physiologic scotoma?

3. Where are negative scotomas located?

4. Where are positive scotomas located?

612. Given a list of terms used to describe topographical features of the retina and instruments used to test for visual field losses, relate each term to its correct description.

Simple detection of a visual field loss is insufficient to give the anatomic location of the causative lesion. The field loss must be plotted according to a standard method, and the field plot must be related to the anatomy of the retina in order to localize the lesion.

Location of Visual Field Defects. The physiological scotoma falls in the temporal visual field. You should remember that the optic nerve head is located in the nasal retina. Figure 1-5 shows why a nasal *retinal* defect is seen as a temporal *field* defect. The retinal image is reversed left for right and top for bottom. Figure 1-6,A, is a diagram of a right retina as seen from *behind;* it is divided into quadrants—superior nasal (SN), superior temporal (ST), inferior nasal (IN), and inferior temporal (IT). The small central circle represents the macula, and the oval represents the optic nerve head. Figure 1-6,B, is a diagram of the visual field of the same eye. Note the change in position of the blind spot. The quadrants of the visual field are named in the same way as the retinal quadrants, but do *not* represent the similarly named areas. Since the location of a lesion differs so much, depending on whether it is represented in the visual field or in the retina, it is extremely important to label any diagram as to what it represents—the field or the retina.

In figure 1-7, you see a typical plot of a left eye's visual field. Note the nomenclature of the various lines and circles. An isopter is a line connecting points of equal visual acuity. It can be compared to isometric lines of equal elevation on a surveyor's map. The "lines of equal eccentricity" are circles plotted around the center of fixation. They aid in the localization of a field defect. The numbers either indicate degrees from fixation and are computed using a tangent table; or indicate the ocular meridian (similar to the axis determination in astigmatism).

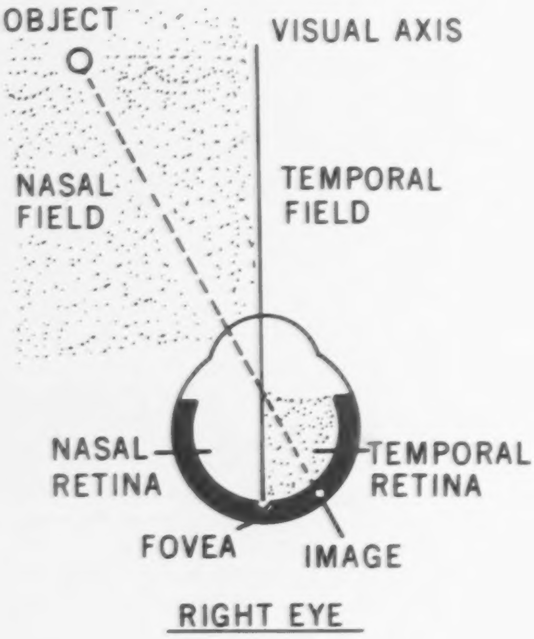


Figure 1-5. Retinal projection.

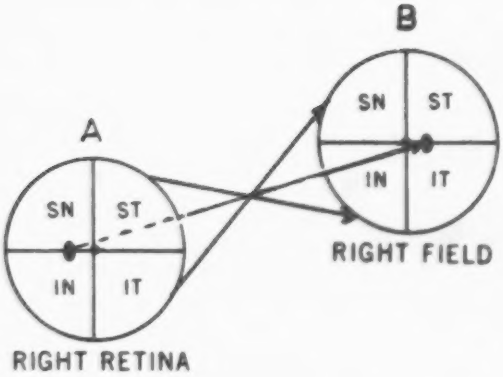


Figure 1–6. Relationship between retina and visual field.

Exercises (612):

1. Match the items in column A with the appropriate terms in column B by placing the correct letter in the blank provided.

Column A

_____ (1) Superior nasal field loss.
_____ (2) Inferior temporal field loss.
_____ (3) Superior temporal field loss.
_____ (4) Inferior nasal field loss.
_____ (5) Central field.
_____ (6) Temporal field.
_____ (7) Isopters.

Column B

a. Inferior nasal retinal lesion.
b. Superior nasal retinal lesion.
c. Superior temporal retinal lesion.
d. Inferior temporal retinal lesion.
e. Location of physiological scotoma.
f. Location of fovea.
g. Lines connecting points of equal VA.

613. Relate various visual field instruments to their function and indicate procedures to take when using each.

A visual field investigation is usually classified as one of two areas—peripheral or central. Peripheral fields are those seen out of the corner of the eye, and central fields are limited to about 30° from fixation. Visual field investigations fall under the general heading of perimetry, and we have several perimetric instruments to measure the visual fields.

Peripheral Field Measurements. Two peripheral field measurment tests are available in the USAF: confrontation field tests and arc perimeter tests. The first method may be used for screening purposes, while the second yields more diagnostic.

Confrontation test. There are many methods of determining the extent of the visual fields; the first and easiest to administer is the confrontation test. The confrontation test is based upon a comparison of the monocular fields of vision of the examiner and the patient, which, assuming their facial conformations to be alike, should be similar. You, as the examiner, should face the patient at a distance of 2 feet. Either you or the patient should flex your knees or rise on your toes so that your heads are on the same horizontal level. Each of you should hold your head normally erect. Instruct patients to close their left eye with gentle pressure of the little finger and fix their right eye upon your left eye. You should close your right eye and fix your left eye upon the patient's open eye. This fixation is continued throughout the test of the patient's right eye. Hold a plain white 1-cm sphere on a wire handle overhead and in a plane midway between you and the patient. Lower the sphere, keeping your hand out of the way, until it is seen by the patient. Assuming similar brow conformation, you and the patient should see the sphere simultaneously. The superotemporal, superonasal, nasal, inferonasal, and inferior limits of the field of vision are similarly compared. To estimate the patient's temporal and inferotemporal limits of vision, hold the sphere behind the plane of the patient's eye and bring it forward until it is visible; in these meridians, the visual field normally extends to 90° or more. Use a similar technique to test the patient's left eye.

If on the confrontation test the field of vision appears to be constricted to a degree not attributable to a prominent nose or brow, or if for any other reason you suspect a visual field defect, a more exact perimetric study is made, employing the perimeter and tangent screen. The average visual field for form is approximately 90° temporal, 62° superotemporal, 52° superior, 55° superonasal, 60° nasal, 55° inferonasal, 70° inferior, and 85° inferotemporal.

The perimeter. The first perimeter was built in 1857 by Aubert and Forster. Almost all the changes that have taken place since then have been improvements in illumination and automation. The basic technique remains the same. There are several types of perimeters in use today: hand or portable perimeters; Ferree-Rand and Brombach

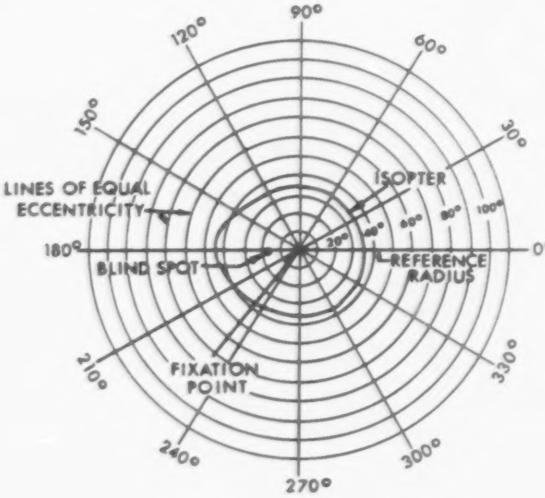


Figure 1–7. Visual field of left eye.

perimeters; arc projection perimeters; hemispherical projection perimeters, and the salad bowl-type like Topcon, Goldmann and Marco.

The perimeter most often found in the USAF today is the Brombach perimeter (fig. 1-8). It resembles an arc with a 33-cm radius, with the patient's eye as its center. An adjustable light source illuminates the arc equally at all points. A head and chinrest are provided to maintain proper positioning of the patient's head. The perimeter is designed to examine peripheral visual fields, but a campimeter attachment may be used to test central fields (fig. 1-9). The radius of the arc is 33 cm; this is equal to the test distance from the patient's eye. Normally, 7 foot-candles of illumination are used with this instrument. The technique of examining visual fields with the perimeter is as follows:

(1) Complete the identification data on the perimetry record chart (fig. 1-10). Note that there are two charts, one for each eye. Don't forget to include test target data (usually 3-mm white), the date of the examination, and your signature. The patient usually should not wear glasses for this test.

(2) Place the right chart in the clip provided on the back of the perimeter.

(3) Occlude the patient's left eye with a plastic eye shield.

(4) Seat the patient comfortably in front of the perimeter and place his or her head in the left side of the chinrest.

(5) Instruct the patient to observe the yellow fixation point at all times. Ensure that the patient does not move either eye the fixation point. Do this by continually observing the patient's eyes during the examination.

(6) While observing the fixation point, the patient should indicate to the examiner when he or she becomes aware of the test object. Usually, a signal system is arranged so that the patient does not speak during the examination (one rap with a coin on the perimeter table indicates the appearance of the test object, while two raps indicate its disappearance).

(7) Demonstrate the movement of the test object from the periphery to the central area.

(8) To test the peripheral visual fields of the patient, place the arc in the horizontal position, and slowly move the test object from the extreme temporal region toward fixation. Mentally note the position where the patient reports visibility of the object. Continue moving the object toward fixation to detect any scotoma. Mark the chart with a dot at the position where the patient reported detection of the test object.

(9) After the Temporal field has been investigated, move the test object to the extreme nasal meridian and test the nasal field, marking the chart as before.

(10) Unlock the arc and rotate it to the 445° – 225° position (as measured from your right or the patient's left). Lock the arc.

(11) Plot the superior nasal and inferior temporal fields in the same manner as you plotted the horizontal fields.

(12) Unlock the arc and rotate it to the vertical position.

(13) Plot the superior and inferior fields.

(14) Unlock the arc and rotate it to the 135° – 315° position.

(15) Plot the superior temporal and inferior nasal fields.

(16) Remove the right chart and replace it with the left.

(17) Move the occluder to the patient's right eye.

(18) Position the patient's chin in the right half of the chinrest.

(19) Repeat procedures h through n, testing the patient's left eye.

(20) When the test is completed, turn the instrument off; remove the occluder and charts.

(21) Before presenting the charts to the optometrist, outline the peripheral visual fields of each eye by connecting the dots with straight lines. These lines are called isopters, and represent the threshold of vision for the size and color of target used.

(22) Attach the perimeter charts to the basic eye examination used in your clinic (or to the referral form, if used) and present them to the optometrist.

Central Visual Field Measurements. We have discussed the examination of the peripheral area of the visual field by the confrontation fields and arc perimeter tests. We will now take up the examination of the central visual field. Here again, we have a screening device known as the Harrington-Flocks tachistoscope. If an abnormal condition shows up, you will move on to the tangent screen, of which there are two types to be discussed.

The Harrington-Flocks tachistoscope. The Harrington-Flocks tachistoscope (fig. 1-11) is a rapid simple screening test for relatively prominent central visual field defects. This instrument consists of a series of large test cards printed with fluroescent ink and a stand with chinrest, a cardholder, and a UV light source. Each test card has a series of different patterns of dots that are made visible only under ultraviolet radiation and a black spot used as a fixation point. The UV lamp may be left on for demonstration purposes or flashed in 1/4-second bursts for testing. Room illumination should be 5 ft-c. Central fields (25°) are tested. Test procedures are as follows:

(1) Complete the identification data on the record chart (fig. 1-12). One chart is to be used for both eyes. Glasses may be worn.

(2) Occlude the patient's left eye.

(3) Seat the patient comfortably in a chair or on a stool, and place his or her chin in the chinrest. Turn the toggle switch to ON.

(4) Instruct the patient to observe the black fixation dot at all times. Tell the patient that the test consists of observing the white card and reporting the number of dots that he or she sees. Demonstrate, leaving the light on for a few seconds.

(5) Expose the second test card and depress the flasher button. The patient should report seeing three dots. If the patient reports seeing the cross, move his or her head forward or backward, flashing after each adjustment until the cross disappears.

(6) Change to the third card and flash the light. Continue changing the cards and flashing the light until the patient makes an error. If an error is made (that is, the patient reports three dots when there are four, or reports visibility of large crosses), flash the light once more. If the error is repeated, have the patient indicate or describe what he or she saw. Cross out the unseen dots on the composite test chart.

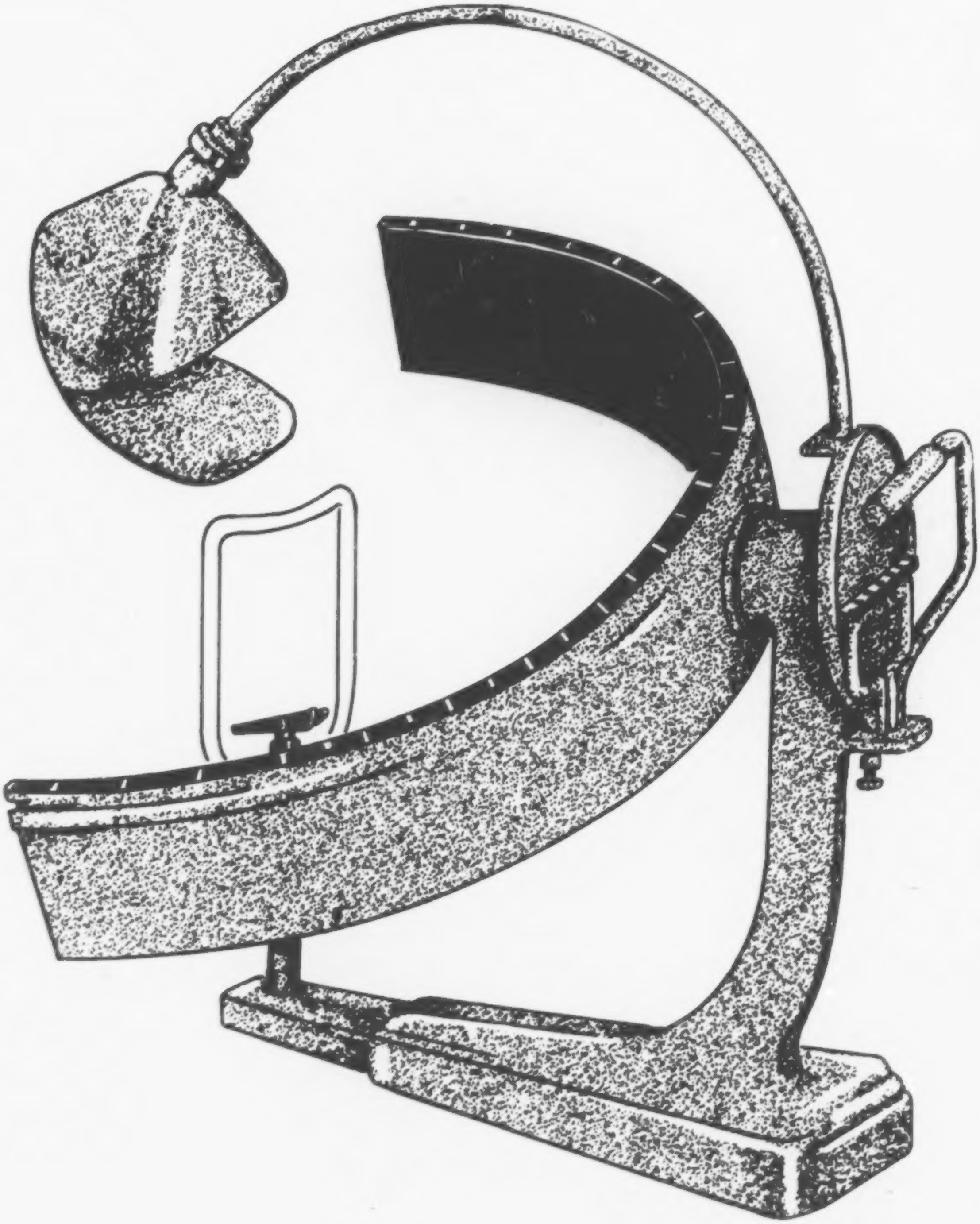


Figure 1–8. The Brombach perimeter.

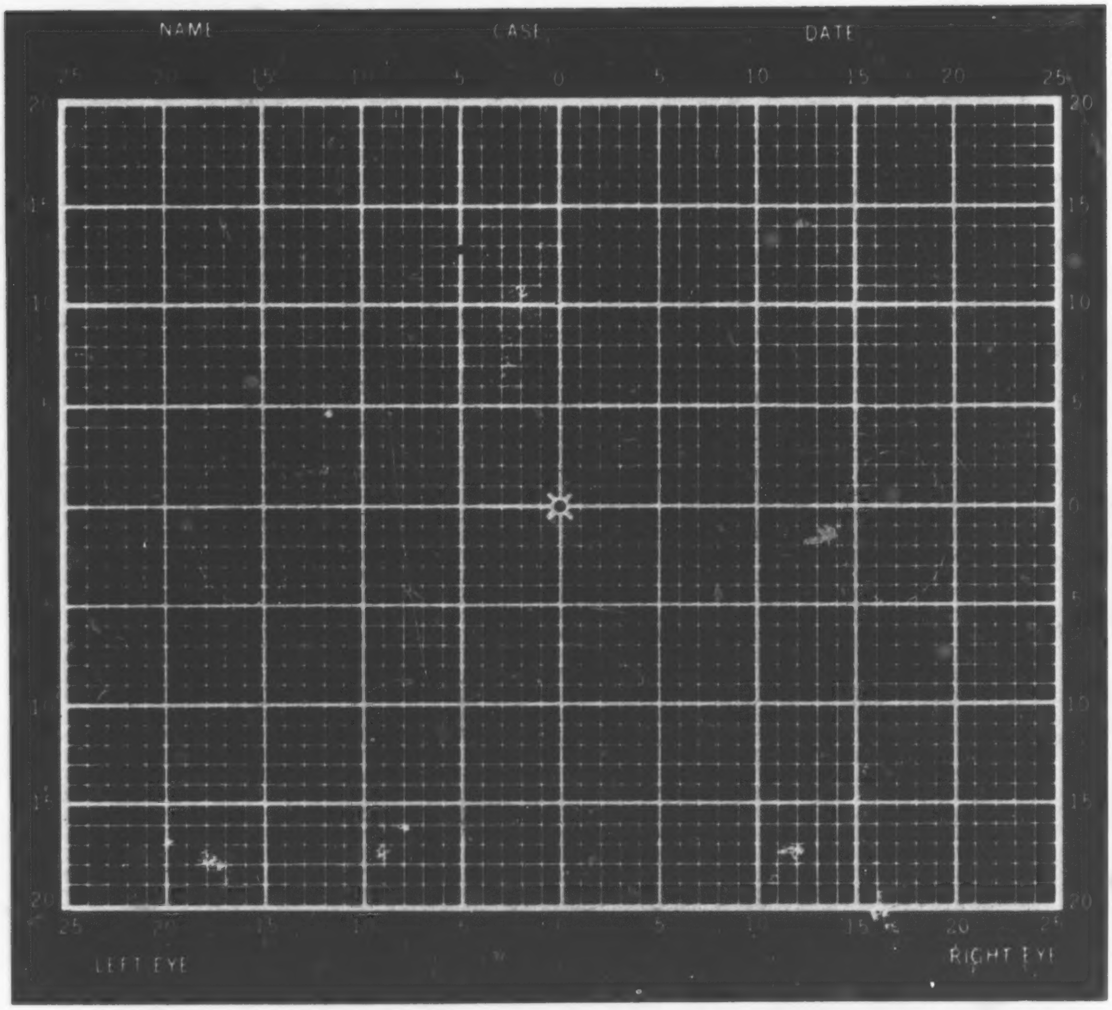

NAME
CASE
DATE
25 20 15 10 5 0 5 10 15 20 25
20 15 10 5 0 5 10 15 20
LEFT EYE
RIGHT EYE

Figure 1–9. Campimeter attachment.

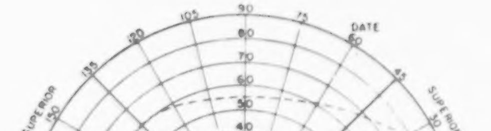

DATE
SUPERIOR
NASAL FIELD
TEMP FIELD
INFERIOR
90 105 120 135 150 165 180 195 210 225 240 255 270 285 300 315 330 345 0 15 30 45 60 75
10 20 30 40 50 60 70 80 90
PERIMETER CHART (RIGHT)

Figure 1–10. Perimetry record chart, OD.

(7) Change the occluder to the right eye and repeat steps 5 and 6, reminding the patient to maintain fixation on the black dot.

(8) If any dots are not seen, a further investigation with the aid of the tangent screen is indicated.

(9) Attach the composite record chart to the referral or basic form and submit it to the doctor.

The Amsler grid. The Amsler grid chart is the last page of the Harrington-Flocks series. Amsler charts can also be obtained separately. The chart consists of grid lines with a central fixation dot. The squares on the grid are 5 mm is size (fig. 1-13) and subtend an angle of 1° at 30 cm.

The Amsler grid is designed to detect abnormalities in the heart of the central field. That area covers some 20° of the central field (fig. 1-14). Most importantly, it can detect visual distortions that are prominent in the macular and periomacular area. This distortion is usually caused by

281

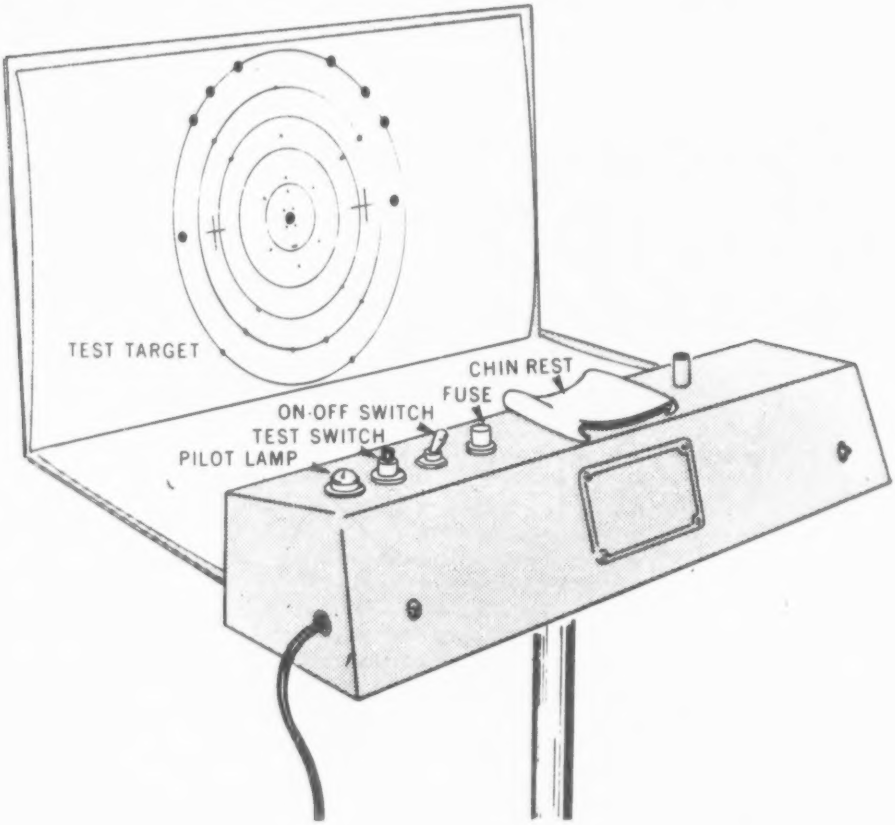


Figure 1–11. The Harrington-Flocks tachistoscope.

edema. Figure 1-15 shows you where on the retina the Amsler grid works.

The test is relatively simple to perform and goes as follows:

(1) The same lighting as used with the tachistoscope, occlude the patient's left eye.

(2) Have the patient place chin in chinrest of the tachistoscope.

(3) The patient will fixate on the fixation dot with right eye and report what is seen.

Questions that may be helpful to the patient:

(1) Is the center spot visible? If not, a central scotoma may be present.

(2) While viewing the center, can you see all four sides? If not, an arcuate scotoma may exist, this is an arc shaped scotoma located outside the test area of the Amsler grid. The patient may have a centrocecal scotoma, one which lies between the central fixation of the field and the blind spot.

(3) Do you see the entire grid? Are there any defects? If any areas are absent, then a paracentral scotoma may be present, one that is located around the central fixation dot.

(4) Are the horizontal and vertical lines straight and parallel? If not, then metamorphopsia is present, a distortion of the lines caused by macular or perimacular edema.

Figure 1-16 indicates what a patient might see if metamorphopsia exists or scotomata are present.

The tangent screen. The tangent screen (fig. 1-17) is a dull black felt cloth, usually about 2 meters square, either fixed to the wall or suspended from rollers. A white button is affixed to the center of the screen as a fixation point. The test distance is either 1 or 2 meters. Markings on the tangent screen include circles every 5° (for 1-M test distance) and radial lines every 15° or 30°. The lines and circles help to localize the test object when recording on the tangent screen chart (usually locally reproduced). The blind spot is also indicated on most tangent screens. The test procedures are as follows:

(1) Complete the identification data on the tangent screen chart. Indicate which eye is being tested. Since the tangent screen tests central visual fields, record the visual acuity. Also record the test distance (usually 1 M), test object color (usually white), size of test object (usually 2 mm), and illumination [usually about 10 foot-candles (ft-c)]. The patient should have any errors of refraction corrected for the test distance.

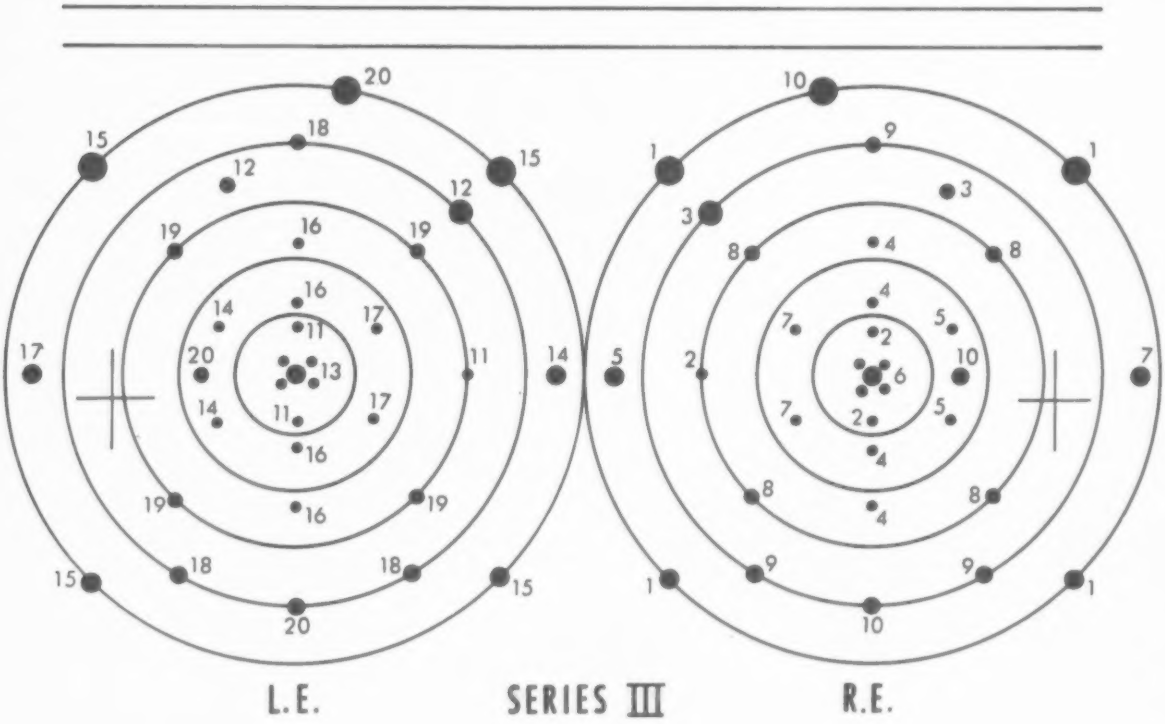


Figure 1–12. The Harrington-Flocks record chart.

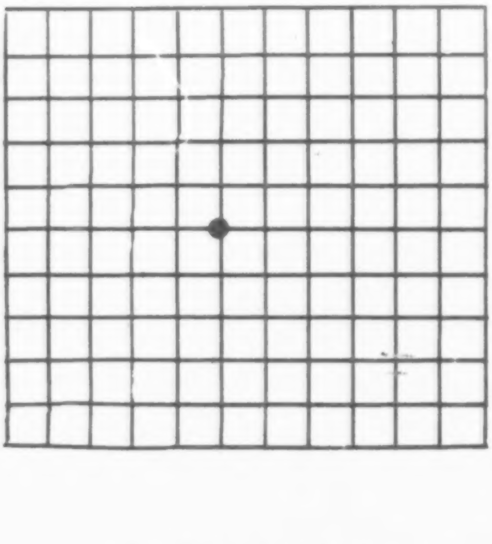


Figure 1–13. The Amsler grid.

(2) Occlude the patient's poorer eye if there is a difference in vision—left eye if vision is equal—with a plastic shield.

(3) Seat the patient on a stool so that fixation point and eyes are on the same horizontal plane. A 1-M thread attached to the tangent screen will facilitate positioning, as will a chinrest.

(4) Instruct the patient to observe the fixation button at all times. Tell the patient that you will move a white pin (show the patient the target) around in his or her field of view, and that he or she is to report the appearance and disappearance of the pin (a signal system may be used). Ensure that the patient does not move his or her eyes from the fixation spot.

(5) Demonstrate the appearance and disappearance of the target by slowly passing it through the blind spot. Reassure the patient that disappearance of the target is normal. Repeat the demonstration until you are assured that the patient can accurately report the disappearance and appearance of the target.

(6) Begin testing the patient by measuring the blind spot, always moving the target from a nonseeing area to a seeing one. Insert a black-headed maptack or pin at the points where the patient reports visibility of the test object. Test eight meridia to outline the blind spot.

(7) Test the remainder of the field by moving the test target inwards from the periphery along the radial lines. If a

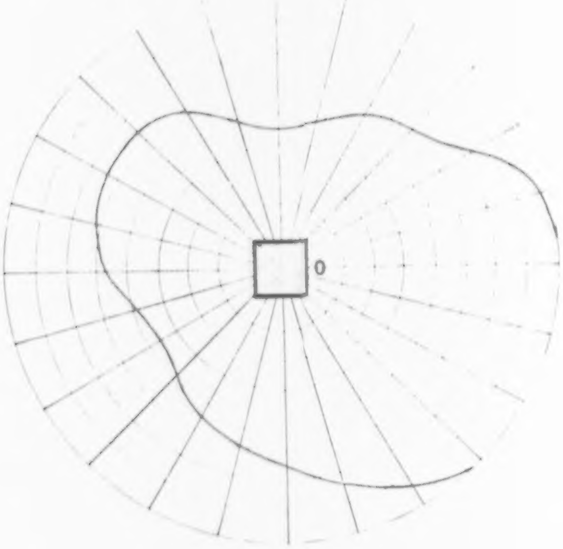


Figure 1–14. Amsler grid in field.

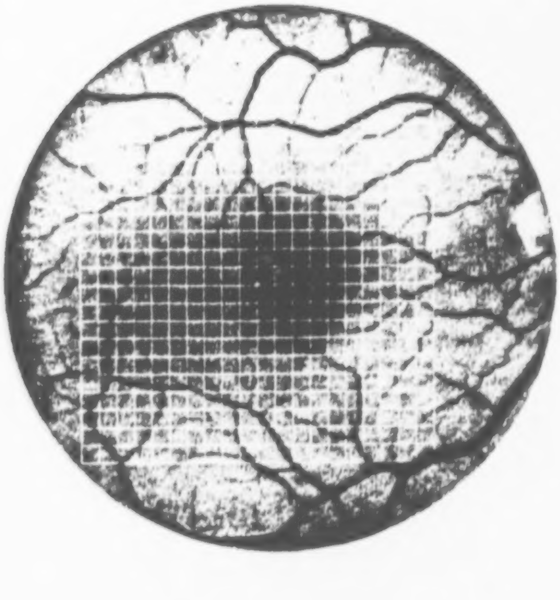


Figure 1–15. Amsler grid covering retina.

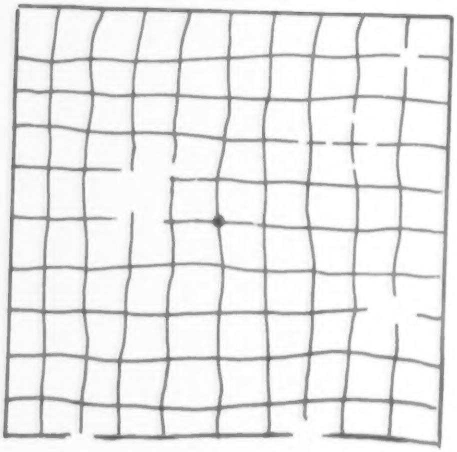


Figure 1–16. Metamorphopsia and scotomas.

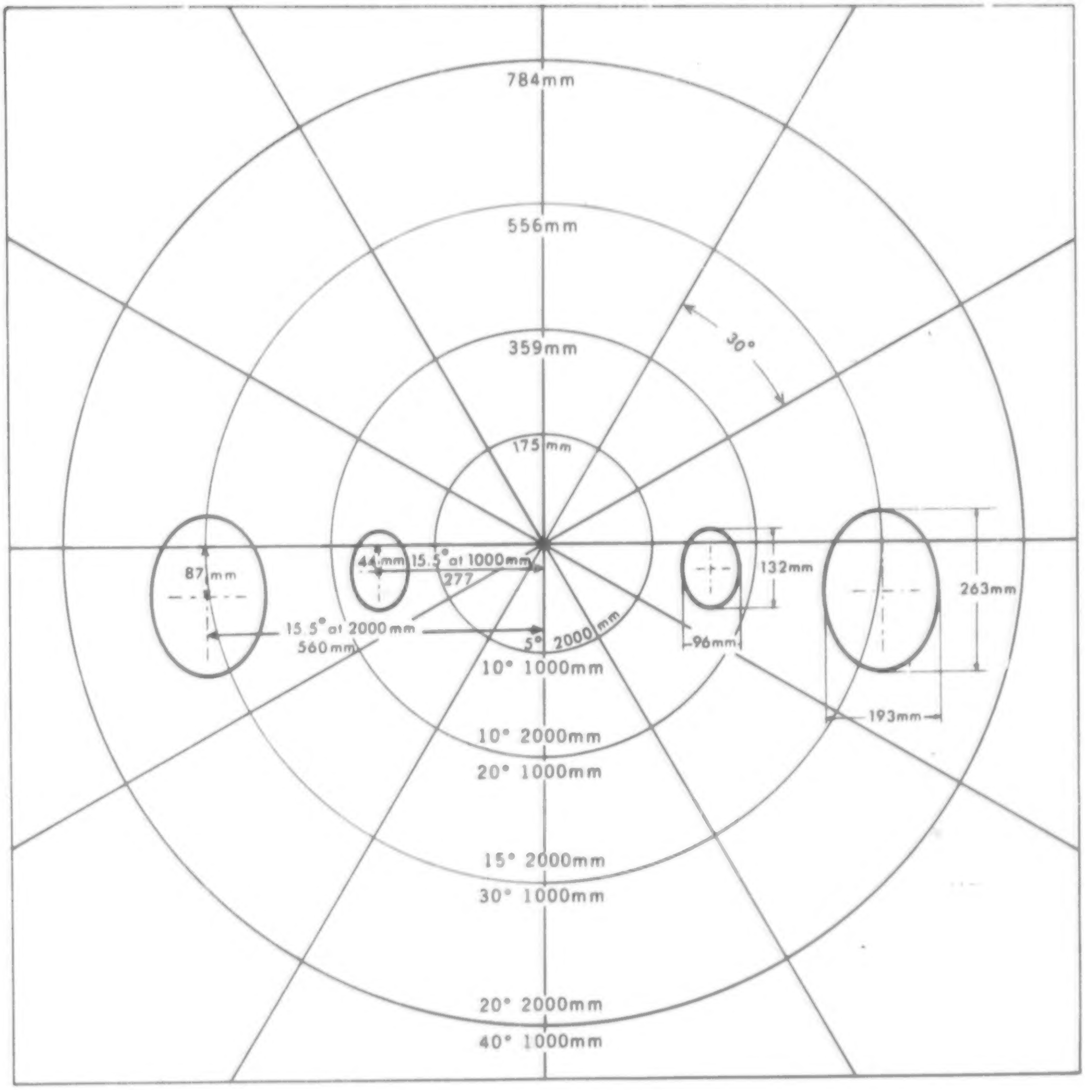

784mm
556mm
359mm
30°
175mm
87 mm
44 mm
15.5° at 1000mm
277
132mm
263mm
15.5° at 2000mm
560mm
5° 2000mm
96mm
10° 1000mm
193mm
10° 2000mm
20° 1000mm
15° 2000mm
30° 1000mm
20° 2000mm
40° 1000mm

Figure 1–17. The tangent screen-1 meter and 2 meter test dimensions.

scotoma is found, stop and plot it from the nonseeing to the seeing areas. Occasionally test one of the circular lines so that all of the field is tested. Another standard practice is to place a pin on the felt where the patient first reports visibility of the test target as you move it inwards from the periphery.

(8) When the entire central field has been tested with the 2-mm white (W) target, the central field or any suspicious areas may be tested with a 1-mm W target.

(9) Transfer the findings from the tangent screen to the record chart. Record the test object size and test distance in the form of a fraction:

$$\text{test object in } \frac{\text{millimeters}}{\text{test}} \text{ distance in millimeters}$$

Example: A 2-mm white target used on the 1-M tangent screen produces an isopter labeled 2/1000.

(10) Change the occluder to the patient's right eye.
(11) Repeat procedures *e* through 9.
(12) Connect all dots indicating equal isopters.
(13) Present the chart to the doctor.

The Autoplot tangent field. DOD stocklists an updated version of the tangent screen (fig. 1-18). This device projects a spot of light onto a neutral-colored light background. The size and color of the test spot may be changed by the examiner. The area explored is up to 25°. As the patient sits in the examining chair, his or her head is held in place by a chinrest. One eye is occluded, and he or she is instructed to fixate a target on the test screen which is either 1 or 2 meters away. The examiner tests the visual fields in the same manner as with the tangent screen, except that he or she is able to control the test spot while seated next to and facing the patient. The test spot is controlled by a pen-like recording device located on the instrument. When the patient signals the appearance or disappearance of the target, the examiner can record the target position directly on the record sheet which is shown in figure 1-19. This instrument eliminates the presence of a distracting test wand and also eliminates the necessity of transcribing results from a group of pins to a record chart.

Exercises (613):

1. Match the description in column A with the appropriate instrument or term in column B. Column B answers may be used more than once or not at all.

Column A

_____ (1) Within 30° of fixation.
_____ (2) Screening test.
_____ (3) Usually done without glasses.
_____ (4) Farthest test distance.
_____ (5) Technique to measure scotomas.
_____ (6) Grid test.
_____ (7) 50° to 90° from fixation.
_____ (8) Needs marking pins.
_____ (9) Needs "signal system."
_____ (10) Primarily checks macula.
_____ (11) Eliminates test wand in central fields.

Column B

a. Confrontation fields.
b. Arc perimeter.
c. Auto plot.
d. Tangent screen.
e. Central fields.
f. Peripheral fields.
g. Harrington-Flocks.
h. Campimeter.
i. Seeing to nonseeing.
j. Nonseeing to seeing.
k. Amsler grid.

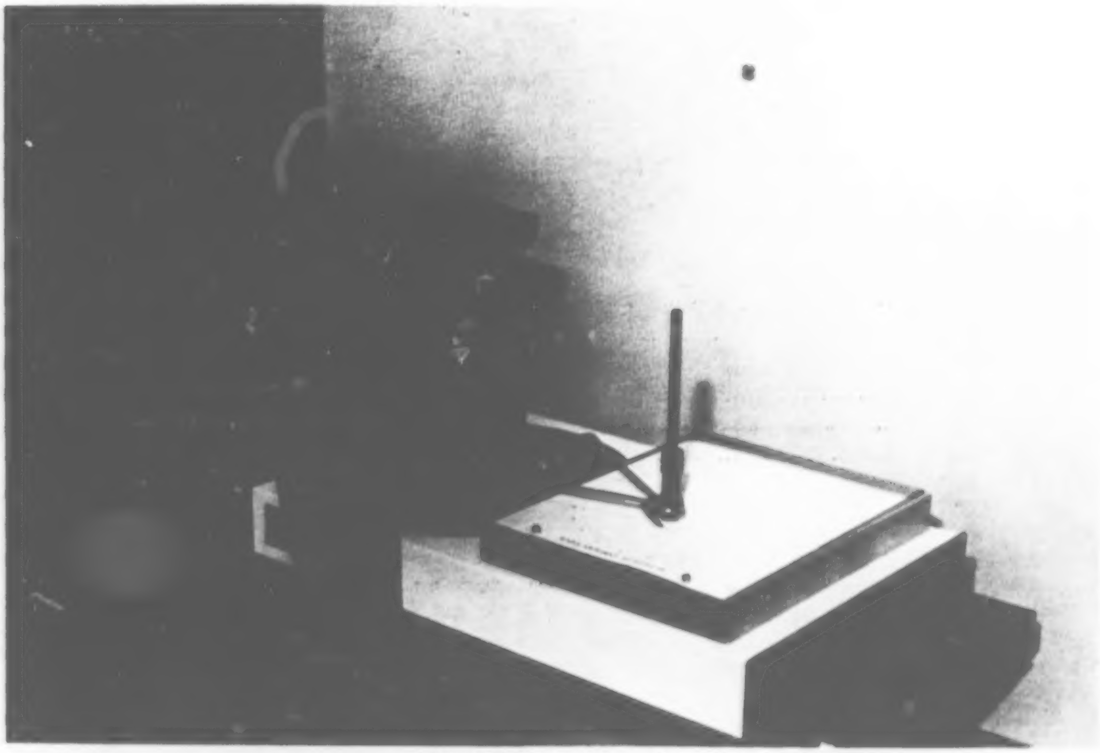
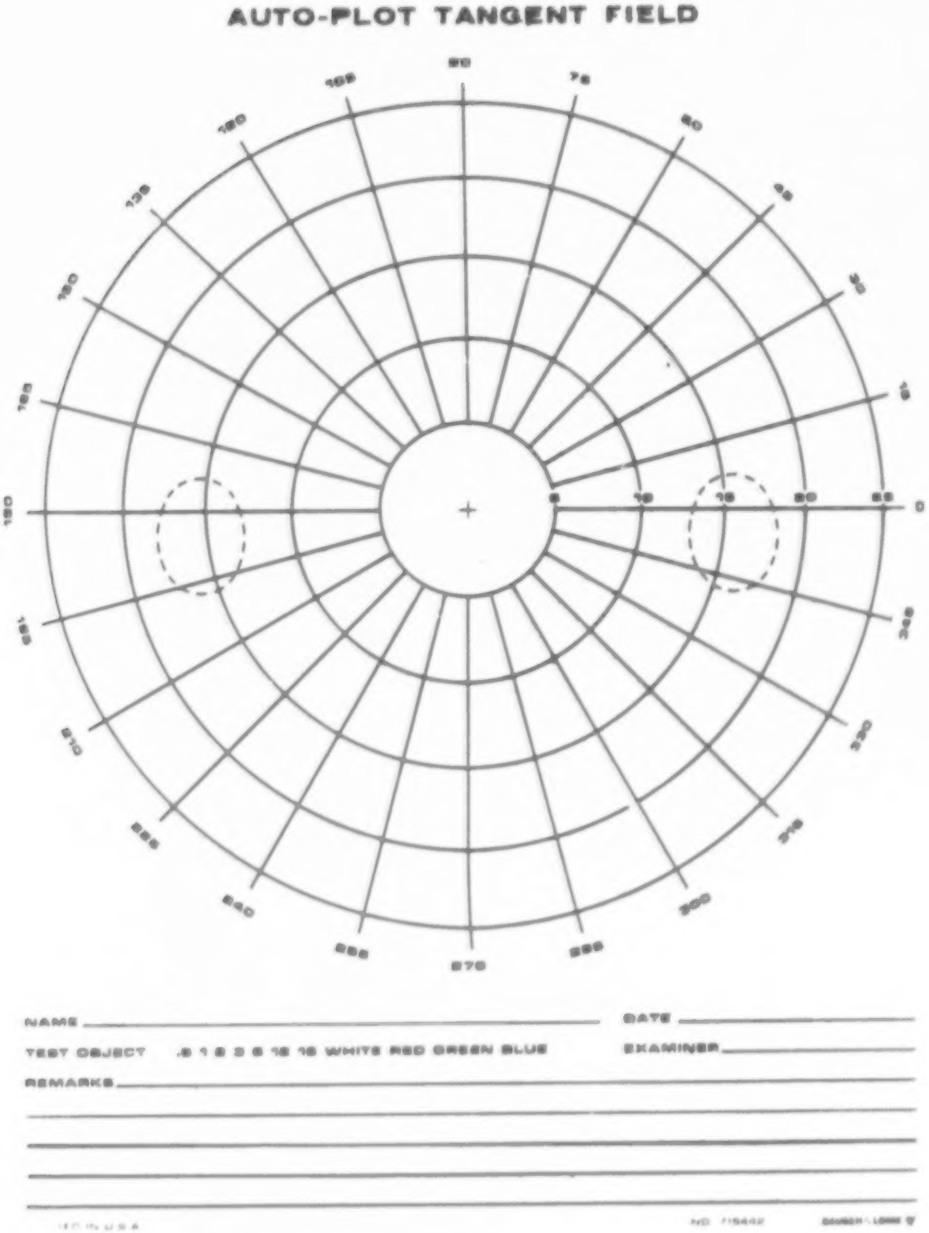


Figure 1-18. Auto-plot tangent screen.



AUTO-PLOT TANGENT FIELD

90
75
60
45
30
15
0
345
330
315
300
285
270
255
240
225
210
195
180
165
150
135
120
105
5
10
15
20
25

NAME ____________________ DATE ____________

TEST OBJECT .5 1 2 3 5 10 15 WHITE RED GREEN BLUE EXAMINER ____________

REMARKS ____________________

IN U.S.A.
NO. 115442
BAUSCH & LOMB

Figure 1–19. Auto-plot tangent chart.

614. Relate a list of ocular lesions to their most common visual field defects.

In order to do a visual field exam intelligently, you should have some idea of what you are looking for. If a patient has a history of glaucoma, you should know what portions of the visual field merit special attention. The same is true for other diseases affecting the visual fields. This segments will show you the classic visual fields related to several eye problems.

Etiology of Visual Field Defects. Assuming now that you know how to take visual field measurements, look at a few typical field defects and the etiology of each. Most real fields are not as simple as the examples shown here, and in any case you are not to diagnose any pathology from the field defect, but you should be able to discuss lesion location and etiology intelligently with your doctors.

Opacities of the media. Many patients complain of seeing little spots or hairs floating around in their field of vision. If there is no eye pathology present, these "muscae volitantes" (flitting flies) are due to the shadows of opacities floating in the vitreous body, and may be normal. Cataracts or generalized media clouding usually result in a generally depressed visual field, and larger size targets must be used.

Diseases of the retina and choroid. Both retinal and choroidal lesions produce positive scotoma. The location and shape of these defects vary with the type of lesion. Accurate measurements of the field loss are important in determining the extent and prognosis of the chorioretinal lesion. Most chorioretinal field defects are monocular, but some diseases, such as retinitis pigmentosa, produce a characteristic binocular field defect.

Glaucoma. Glaucoma usually produces a characteristic field loss, depending on the severity of the disease. Since investigation of the glaucoma field illustrates the anatomy of the retinal nerve fibers, we will cover this disease in depth. Refer to the illustrations in foldout 1 (at the back of the volume) as you read this material.

As you know, the retinal nerve fibers are transparent, but if you could look in a patient's left eye with an ophthalmoscope and somehow see these fibers, you would see something like illustration A in foldout 1. The white lines represent the paths of the ganglion fibers as they carry visual information from the rods and cones to the optic nerve. The oval to your right is the optic nerve head, and the central circle indicates the fovea. Illustration B is a plot of the central field of this normal eye. The earliest field defect in glaucoma is shown in illustration C. This defect is called "baring of the blind spot," and is a contraction of the 1/2000 isopter. Perhaps the earliest field defect that you will find during a routine exam is shown in illustration D. The blind spot is enlarged and has a double arcuate scotoma extending from the superior and inferior margins. Sometimes this arcuate scotoma is found only on the superior or only on the inferior margin; in either case, this most characteristic visual field lost is called Bjerrum scotoma.

Illustration E shows an advanced Bjerrum scotoma. The shape of this scotoma conforms to the arc of the nerve fiber bundles in illustration A. IOP may be between 25 to 45 mm Hg, and VA is usually 20/20. Illustration F shows the peripheral field change occurring at this time—a contraction of the superior nasal quandrant. Eventually if the glaucoma is left untreated, the central and peripheral field changes merge as shown in illustrations G and H. The patient usually has 20/20 vision but is aware of ocular discomfort. If the opposite eye has not reached this stage, the patient may not be aware of the field loss! The peripheral field breakthrough in these illustrations indicates a well-established glaucoma, and the small central island of vision in illustration I indicates terminal glaucoma. Central vision may remain 20/20 until the field loss in within 1° of fixation.

Optic nerve lesions. Many retinal lesions are disgnosed and confirmed by the the use of both perimetry and ophthalmoscopy; however, the optic nerve head is the only portion of the optic nerve that is visible, and perimetry is the only way to localize lesions in and behind the optic nerve.

Typical optic nerve lesions, such as papilledema, papillitis, early optic nerve atrophy, and retrobulbar neuritis or multiple sclerosis, usually show fields similar to figure 1-20. Both the blind spot and fixation spot are affected, and VA may be substantially worse than 20/20, depending on the severity of the lesion. If central VA is too poor for the patient to maintain fixation on the center of your tangent screen, place some white tape in the form of an "X" intersecting at fixation and instruct the patient to look at the point where the tape crosses, or appears to cross.

Optic chiasm lesions. As you can see in figure 1-21, some of the optic nerve fibers cross to the other side of the head in the chiasm. Fibers from the temporal retinas remain uncrossed the travel through the chiasm bitemporally, but fibers from the nasal retinas cross over before they enter the optic tracts. This general area is the first place where a single lesion may cause binocular field defects. For instance, a lesion in area 1 will affect the temporal field of one eye only, but if the lesion spreads across the chiasm or originates at point 2, a bitemporal field defect is seen.

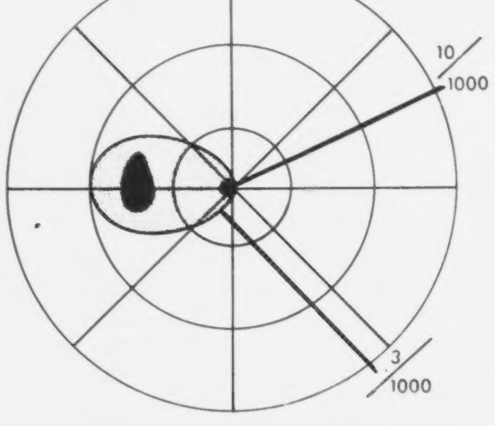


Figure 1-20. Sample field with optic nerve lesion.

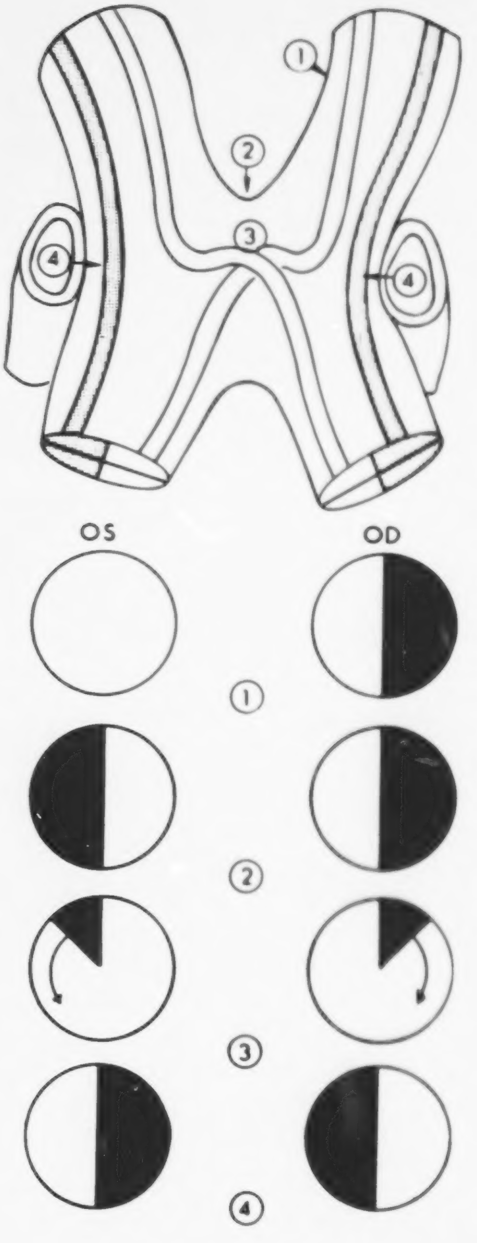


Figure 1-21. The optic chiasm.

The classic bitemporal field defect is caused by a pituitary adenoma (a type of cancer of the pituitary gland, which is located above the chiasm at point 3). As the pituitary gland increases in size, the lesion usually starts as a superior bitemporal quadrantanopsia and progresses to a bitemporal hemianopsia, and finally vision is left only in the superior nasal fields. In very many cases, the patient is completely unaware of his or her field defect because the fields of each eye overlap.

Occasionally, a patient has an aneurysm of the internal or external carotid arteries causing pressure on the right or left temporal fibers (lesions 4). The typical field defect is a nasal hemianopsia because the pressure affects the temporal visual fibers.

Postchiasmal lesions. A general statement can be made about postchiasmal lesions: all postchiasmal lesions produce a homonymous (same-sided, right or left) hemianopia from a single lesion (lesion 5, fig. 1-22). As the lesion location changes from immediately behind the chiasm toward the occipital lobes, the homonymous hemianopsia is more like to become a homonymous quadrantanopsia, as illustrated in lesion 6 figure 1-22. (This particular field was caused by a fracture of the left parietal area of the skull.)

Psychogenic visual fields. You may see two general types of psychogenic visual fields (abnormal fields that have no organic cause): (1) the patient is unaware of the field loss, as in hysterical fields, and (2) the patient is aware

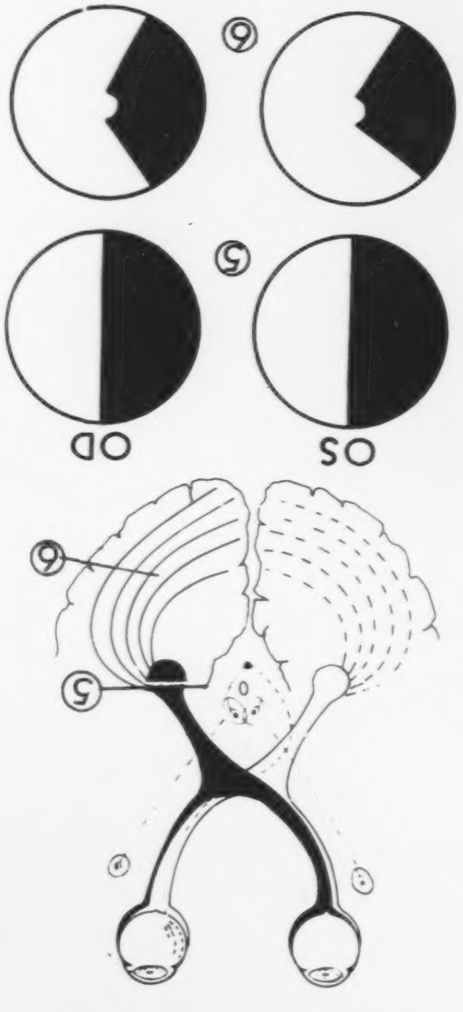


Figure 1-22. Homonymous quadrantanopsia.

of his or her reaction and is malingering. The basic characteristic of hysterical fields is that they usually do not look like any field defect caused by any lesion or lesions in the visual pathway. Figure 1-23 shows a spiral fatigue field, found by rotating the perimeter arc twice around fixation. Figure 1-24, A, is a tubular field found in both hysteria and malingering. The first test was at 1 meter with a 5-mm white target. The patient could see both a 5-mm and a 2-mm target at this distance even though Snellen VA was 20/200. A retest at 2 meters with a 10-mm target showed the same area of contraction on the tangent screen—the isopters would have been ploted as unequal radius circles on the field chart (fig. 1-24, B). Observe that the radius of the field *in centimeters* remained unchanged, even though you would have expected the radius in centimeters to double for the 2-meter distance (the radius *in degrees* should have remained unchanged in a *true* contraction).

If you suspect hysteria or malingering, you may devise some way to trick the patient into revealing this symptom. One method is to clearly mark the defect on the tangent screen in the patient's presence, then take him or her to another room for different tests. While the patient is absent, move the marks closer to fixation. Bring the patient back for a field retest and note whether the defect now coincides with the new marks. Don't yell "gotcha" in front of the hysteric or malingerer, however. Hysterics believe they are sick and will not believe you if you tell them their fields are normal. The malingerer is pretending to have a defect for a reason. Report all your suspicions to your doctor, but not to the patient.

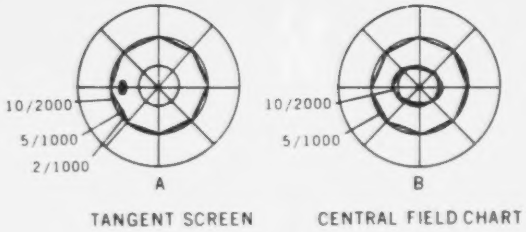


Figure 1-24. Tubular field.

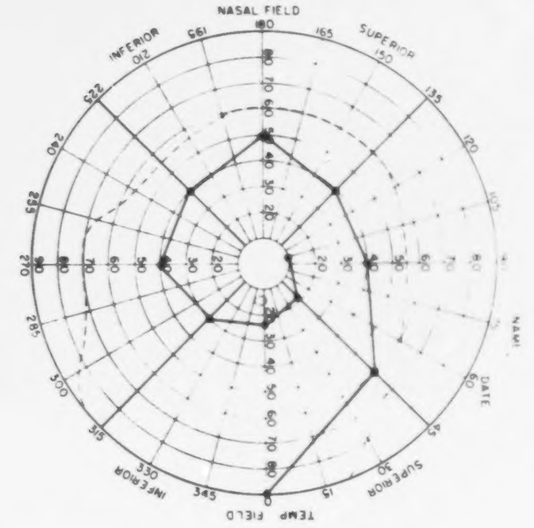


Figure 1-23. Fatigue field.

Exercises (614):

A preliminary diagnosis is listed in column A. Write the type of field you would take in column B, and the area to pay special attention to in column C.

Column A	*Column B*	*Column C*
1. Early glaucoma.		
2. Late glaucoma.		
3. Multiple sclerosis.		
4. Early pituitary adenoma.		
5. Small internal carotid aneurysm.		
6. Head injuries, concussion to parietal areas or occiput.		
7. Malingering.		

Visual Programs

THE PRECEDING CHAPTER dealt with nonspectacle problems and the steps taken to detect, alleviate, or correct such problems. This chapter will deal with problems such as driver's license exams for both civilian and military, then next the safety spectacles portion of your clinic. In the final area of this chapter, we'll take a look at physical profiles and what they mean.

2-1. Visual Programs

In 87 percent of all motor vehicle accidents involving another car or a pedestrian, one or more of the people directly involved in the accident claimed they did not see the car or pedestrian. The accuracy of these figures cannot be verified, but they certainly emphasize the need for good vision while driving. Perhaps this also emphasizes the difference between vision and sight. Many people with adequate sight have poor vision—they cannot integrate the visual information in a meaningful manner.

615. Specify general visual requirements for state and military driver's licenses.

All 50 states, the District of Columbia, and the military services require some type of vision test for initial driver's license examinations. Many states require a vision retest for renewal or for special cases. This unit of instructin is intended to list some of the standards for passing these tests, and show a few items not commonly tested thath may influence visual performance while driving.

Unaided Visual Acuity. Most states require that a driver's unaided binocular farpoint acuity (or the acuity in his or her better eye) be 20/40 or better in order to drive without glasses. If the average 20/20 driver recognizes an expressway sign at 400 feet, the 20/40 driver would recognize is at 200 feet. This means that a 20/40 driver has about 1.9 seconds to recognize, read, interpret, and react to a large sign at 55 mph. Many states require a driver with one blind eye to have better acuity in the good eye than required from binolcular drivers. USAF requires at least 20/70 acuity in the poorer eye and 20/30 acuity in the better eye.

Depth Perception. Many states don't require a depth perception test; and if they do, the test is for stereopsis rather than depth perception. You have already learned the difference between stereopsis and depth perception, and you know that amblyopics or people with poor VA in one eye score poorly on stereopsis tests. In driving, stereo acuity is probably most important when parking or estimating bumper to bumper distance in traffic.

Color Vision. A few states ignore color vision. Fortunately, the colors of signal lights are such that all but severe protanopes can usually recognize them. Many colorblind people can interpret which signal light is ON by remembering that the top light is red (stop) and the bottom light is green (go). A few years ago one state decided to change the tint of their signal lights. They looked prettier to normal trichomats, but dichromats couldn't even tell which light was on (the hues fell in the dochromats' neutral zones).

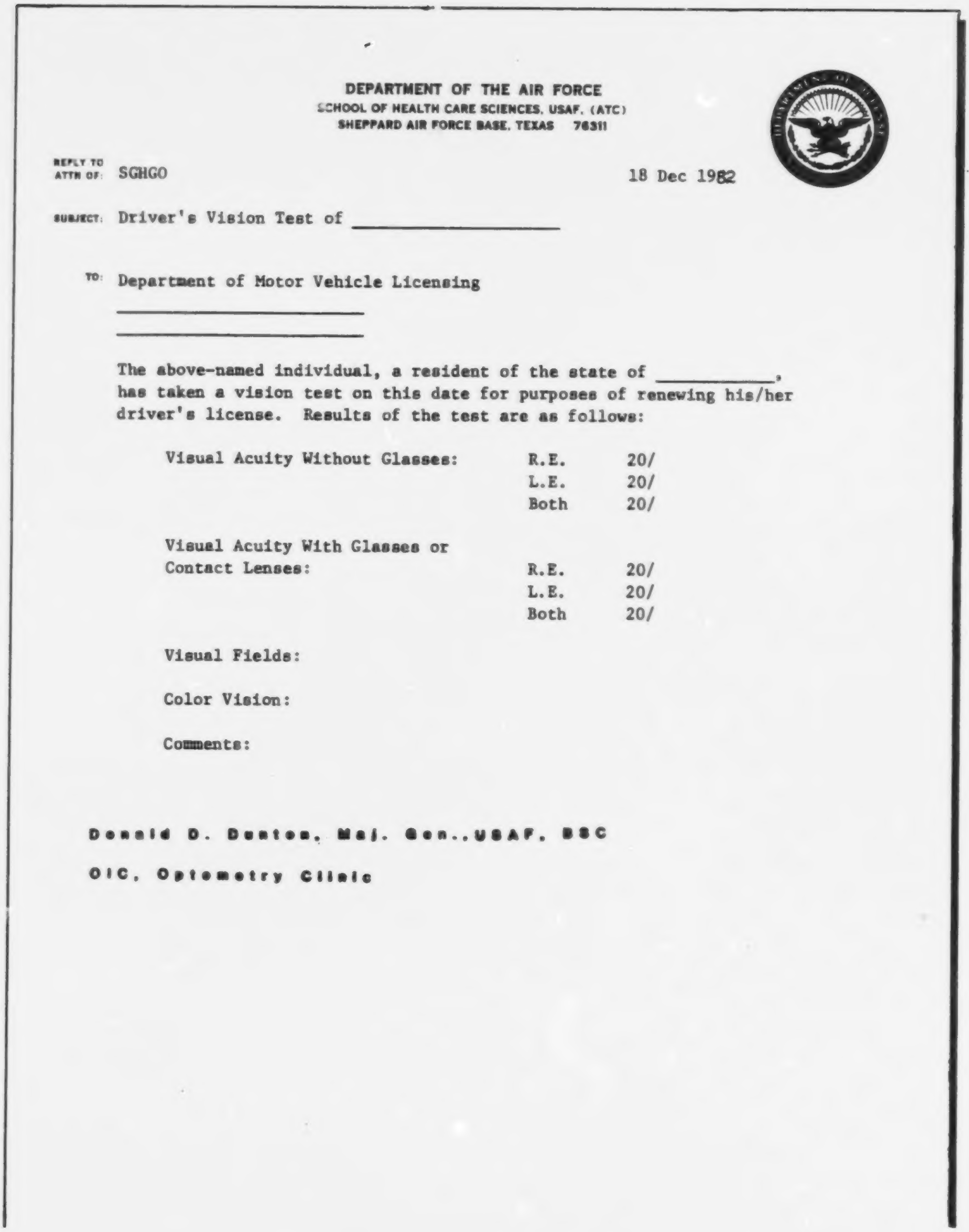
The Air Force requires at least proper recognition of signal lights. You can use your Fransworth Lantern (FALANT) test to score this.

Visual Fields. Peripheral vision is extremely important to the driver for early recognition of cars approaching from the side or attempting to pass. At least 15 states require some type of field test. The USAF requires a minimum 140° binocular horizontal field.

Reexaminations. About 23 states require vision rechecks when a driver's license is renewed. Most of these states supply their own form to be filled out by the examiner, or you can use a form similar to the one in figure 2-1. Sometimes you may see a referral from base driver testing. In a few cases, the referral's commander wants the eye clinic to O.K. the driver's license even though the applicant has failed the eye test. We cannot determine whether or not an applicant can drive; all we can determine is their visual status. If you are pressured to pass an applicant with subnormal vision, use a form similar to the one in figure 2-2. This form states essentially that applicants will be allowed to drive at the discretion of their commander, and any liability for using this driver is the commander's and not the eye clinic's.

Other Tests. Most people recognize the importance of vision in driving, but have we ignored any important vision tests? How about night vision, glare recovery, or presence of scotoma? You have probably seen several patients complaining of headlight glare when driving at night. What can we do for these patients in the absence of ocular pathology or refractive error?

Some patients may wear a Kalichrome tint at night because the yellow tint is advertised to improve vision. Remember that *any* tint absorbs light, and by absorbing light, reduces the energy striking the retina. The use of tinted glasses at night is contraindicated for any driver. Although the driver may be less disturbed by headlights, the tint may reduce the stimulus value of a dim object to below threshold level and the driver may not see it until too late.



DEPARTMENT OF THE AIR FORCE
SCHOOL OF HEALTH CARE SCIENCES, USAF, (ATC)
SHEPPARD AIR FORCE BASE, TEXAS 76311

REPLY TO ATTN OF: SGHGO

18 Dec 1982

SUBJECT: Driver's Vision Test of ____________________

TO: Department of Motor Vehicle Licensing
____
____

The above-named individual, a resident of the state of ___________, has taken a vision test on this date for purposes of renewing his/her driver's license. Results of the test are as follows:

Visual Acuity Without Glasses:	R.E.	20/
	L.E.	20/
	Both	20/
Visual Acuity With Glasses or Contact Lenses:	R.E.	20/
	L.E.	20/
	Both	20/

Visual Fields:

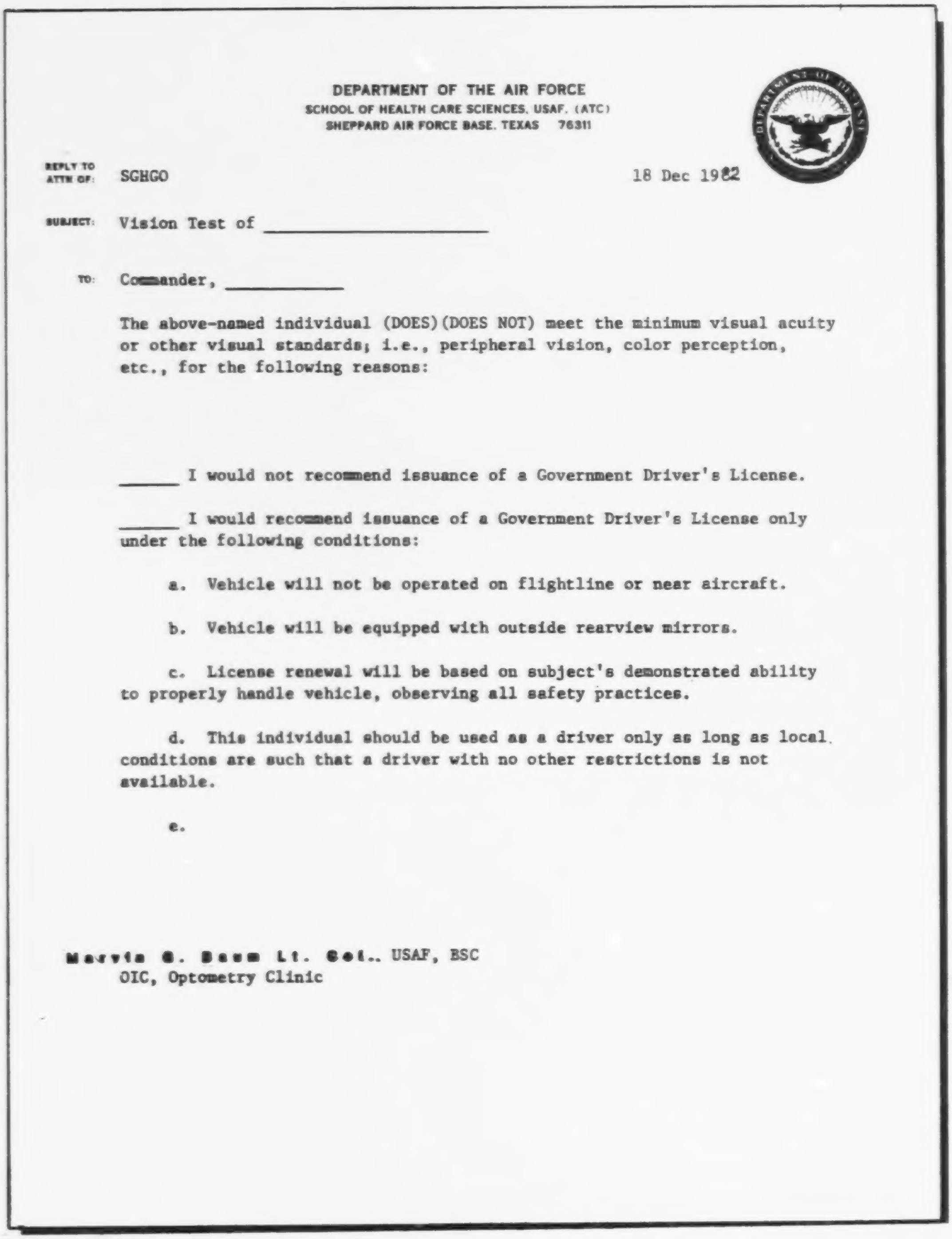
Color Vision:

Comments:

Donald D. Denton, Maj. Gen., USAF, BSC

OIC, Optometry Clinic

Figure 2–1. Sample civilian drivers's license exam form.



DEPARTMENT OF THE AIR FORCE
SCHOOL OF HEALTH CARE SCIENCES, USAF, (ATC)
SHEPPARD AIR FORCE BASE, TEXAS 76311

REPLY TO ATTN OF: SGHGO

18 Dec 1982

SUBJECT: Vision Test of ____________________

TO: Commander, __________

The above-named individual (DOES)(DOES NOT) meet the minimum visual acuity or other visual standards; i.e., peripheral vision, color perception, etc., for the following reasons:

_____ I would not recommend issuance of a Government Driver's License.

_____ I would recommend issuance of a Government Driver's License only under the following conditions:

a. Vehicle will not be operated on flightline or near aircraft.

b. Vehicle will be equipped with outside rearview mirrors.

c. License renewal will be based on subject's demonstrated ability to properly handle vehicle, observing all safety practices.

d. This individual should be used as a driver only as long as local conditions are such that a driver with no other restrictions is not available.

e.

Marvin G. Baum Lt. Col., USAF, BSC
OIC, Optometry Clinic

Figure 2-2. Driver's license exam form (Military).

Exercises (615):

1. What are the binocular unaided VA requirements for most states in order to drive without glasses?

2. What are the VA requirements for USAF drivers of Government vehicles?

616. State the procedures concerning use of safety glasses.

Safety Glasses. This area has changed in the last three years. The clinic's responsibility has been reduced to just giving examinations to those civilians who are eligible and military personnel.

Role of technician. Some technicians in the field are more deeply involved in the safety programs than others. The majority of the technicians screen authorized wearers of safety glasses and either refer them to the clinic optometrist or reorder the glasses with the present Rx.

According to AFR 167–3, *Medical Services Ophthalmic Services*, industrial prescription and plano safety glasses will *not* be ordered through our military optical fabrication laboratories. Although, one pair of industrial thickness clear prescription lenses in a standard S–10 frame for active duty military personnel can be ordered. (CAUTION: These spectacles are not intended for use as a substitute for industrial safety glasses. These are only for temprary use until the local fabrication lab can fill the order on the industrial safety glasses. S–10 frames are not industrial safety frames.) AFR 167–3 mnentions that one pair of industrial thickness plano clear lenses in the S–10 frame can be ordered for monocular patients who require protection for the remaining eye. Finally, in the area of safety, one pair of plano clear lenses in a S–10 frame can be ordered for practicing dental officers, hygienists, and technicians as a protective device against hazardous debris and mouth contaminents when using high-speed dental equipment. Concerning the dental glasses, they are not industrial thickness but, of course, have undergone the chemical lens treatment.

Now let's look at the procedures for handling those patients and their industrial safety glasses in situations other than those mentioned earlier. The only way personnel can be authorized industrial safety glasses is by working in a designated eye hazardous area. Normally, the supervisor in areas classified as eye hazardous will survey their personnel and determine who may need our services. The requirements the supervisors have to work with are:

a. The person has no habitual Rx but is complaining about visual problems.

b. The person has prescription glasses and is complaining of visual problems.

c. The person has prescription glasses but has broken them. From these requirements, the supervisors will send only the personnel that need care.

How you handle this influx of patient flow is basically up to you and your docotr. Usually the supervisors located in eye hazardous areas will contact you to inform you that they have several people in need of a check up. From this point it depends on how you manage your clinic. Do you have a regularly scheduled screening clinic? Do patients walk in unscheduled during your duty day for screenings? Does your doctor have slots in the schedule to allow for observation of screened patients? Do you have a good rapport with your appointment desk? Do you make your own appointments?

However you handle it, as long as it's effective and compatible to all involved, then it's good.

A suggested method is to have the requesting supervisor make a list of the personnel that have a need. Meanwhile, you and your doctor have decided that three or four appointments a day, scattered in the schedule, will be set aside for the next two weeks. Next, you arrange a time to screen each person on the list. From the screening, you can determine those that need a full examination, thereby placing them in the slots set aside for that purpose. Those individuals who were screened but do not need a full exam would have their present Rx or plano industrial thickness glasses ordered as follows:

(1) Using a DD Form 771, Eyewear Prescription, or local optical lab form, fill it out using the patient's present Rx or print "plano" in Rx are of the form. Leave "TO" and "FROM" address blocks empty on the DD Form 771.

(2) Your doctor will sign the form.

(3) The patient will hand-carry all copies of the form back to the requesting supervisor.

(4) For those who needed the exam, simply follow the same procedure using the patient's new Rx.

The forms go back to the requesting supervisor and are attached to a completed Form 1348–6, Non-NSN Requisition. These forms are then forwarded to base procurement for local purchase from a predesignated lab, billing the using organization.

Some bases are predominantly manned by a large civilian population and have numerous eye-hazardous areas. If you are stationed to one of these facilities, you job may become more involved. You may be in a position of ordering directly form the local lab and taking care of the fitting anbd adjusting afterwards. Your doctor may see only patients of this type. Whether you do all of it or just fill out the form, it is recommended to request the patient to return to you with medical records, if applicable, for the initial adjustment of the glasses. Maybe it will increase your patient count.

Exercises (616):

1. When the military lab does provide safety lenses, which style frame is used?

2. What is the requirement for an individual to be authorized industrial safety glasses?

3. What are the three requirements supervisors use to determine which personnel need your clinic's care?

4. What form(s) is/are used by the optometry clinic to begin the process of ordering safety glasses?

2-2. The "Eye" Portion of the Physical Examination

AFR 160-43, *Medical Examinations and Medical Standards*, Chapter 2, describes how the physical examination is to be accomplished. AFM 160-17, *Examination Techniques*, describes eye examination procedures. Since some 91255 reservists and ANGs participate in taking physicals and since active duty 91255s may be asked to verify certain eye findings, the procedures for testing eyes are summarized next.

617. Cite selected facts about the eye findings to be included in a physical examination.

Medical History. All physical exams begin with a detailed medical history. The SF 93, Report of Medical History, accompanies the SF 88, Report of Medical Examination, when examinations are made for the following purposes:

a. Before entrance into active military service.
b. Before termination of active military service.
c. Before appointment of enlistment in the Reserve Forces.
d. Before appointment to Officer Training School.
e. Before acceptance to the Professional Officer's School (AFROTC).
f. Periodically.
g. When required by any regulation or directive.

Report of Medical Examination, SF 88 (fig. 2-3). The instructions for completing the eye portion of SF 88 are given below. These instructions contain only the items that you will fill in.

Item 26. Pupils (Equality and Reaction). Observe the size, shape, and equality of the pupils, and pupillary reactions (direct, consensual, and accommodative). Record and investigate any abnormalities. If normal put PERRLA in item 26 which means pupils are equally round and react to light and accommodation. Now if you find an abnormality, write in the portion of the abbreviation that is applicable, leaving out the letter(s) for the one(s) that is/are abnormal; for instance, PRLA, which means pupils react to light and accommodation but are not equally round. The abbreviation goes in item 26, the explanation goes in item 73.

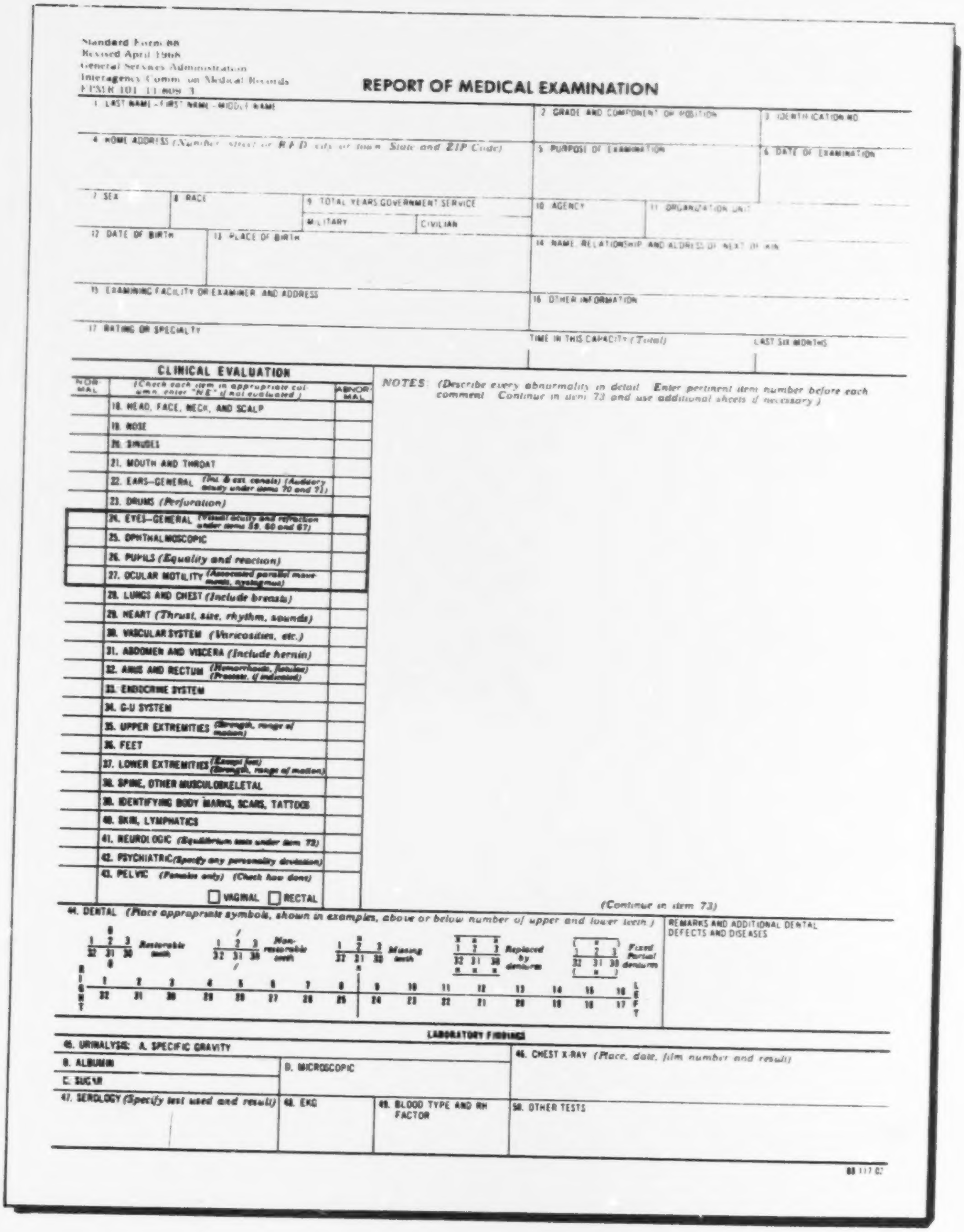
Item 27. Ocular Motility (associated Parallel Movements, Nystagmus). Observe the gross ocular mobility to determine concomitant movement of the eyes in the six cardinal directions, and to detect nystagmus or nystagmoid movements. Examinations for some purposes also require entries in tiems 62 thorugh 68. In item 26, indicate Nystagmus if seen, then record an entry similar to the follwoing in item 73: "Very fine mystagmoid movements of both eyes, at rest and in all directions of gaze. Fast component to the right. Examinee was not aware of this. Probably congenital." As in previous subject, pertinent information should be put in the item area and explanation in item 73.

Item 54. Color Eyes. This item is self-explanatory. (See fig. 2-4.)

Item 59. Distant Vision. Record first the best uncorrected vision of each eye, using a standard 20-foot eye examination or the Vision Test Apparatus, Near and Distant (VTA-ND). Complete instructions for the use of the latter alternative are included with each instrument. Test charts for visual acuity vary, but in general the examinee must correctly name approximately 75 percent of the letters on a given line in order to be credited with that degree of visual acuity. Applicants for flying training must name all the letters on a given line to be credited with that degree of visual acuity. Record visual acuity in the form of a fraction, with a numerator indicating the distance in feet at which the letters were read (usually "20") and a denominator indicating the distance in feet at which a person with average vision could read the letters. Use metric units if the charts are designed for such measurement. It is unnecesary to qualify the simple fraction further—for example "20/30 +2." If the distant acuity is less than 20/20 in either eye, also record the best correctable visual acuity. *This item is required on all physical examinations*.

Item 60. Refraction. Each physical examination for flying training requires a cycloplegic refraction and must be to 20/20 visual acuity (10 of 10 letters correct). On every examination, regardless of purpose, complete this item when distant visual acuity is less than 20/20. Enter the prescription that gives the best correct vision and record the source of the prescription after the word "Refraction." Enter the word "cycloplegic," "manifest," or, if you get the prescription from the patient's spectacles, enter "by lens." Individuals taking flying training (Classes 1 and 1A), or initial enlistment and commission physicals, must not wear contact lenses during, or for 21 days preceding, the exam. (NOTE: All applicants for flying training, service academies, and the AFROTC Scholarship Program, including the Professional Officer's Course, must have one drop of fluorescein placed in each eye immediately after completing the near and distant visual acuity test. Before you instill the fluorescein, advise the patient that if he or she is wearing "soft lens" contacts, the fluorescein will impart a permanent green tint to the lens. In item 60, SF 88, enter whether or not contacts were found in place. Place this entry between "60" and "Refraction" in the following manner; C.L. Yes or C.L. No.)

Item 61. Near Vision. Use Chart Set, Vision Testing, Near Vision at approximately 14 inches, or the VTA-ND to



Standard Form 88
Revised April 1968
General Services Administration
Interagency Comm. on Medical Records
FPMR 101-11.806-3

REPORT OF MEDICAL EXAMINATION

1. LAST NAME - FIRST NAME - MIDDLE NAME
2. GRADE AND COMPONENT OR POSITION
3. IDENTIFICATION NO.
4. HOME ADDRESS *(Number, street or R.F.D., city or town, State and ZIP Code)*
5. PURPOSE OF EXAMINATION
6. DATE OF EXAMINATION
7. SEX
8. RACE
9. TOTAL YEARS GOVERNMENT SERVICE — MILITARY — CIVILIAN
10. AGENCY
11. ORGANIZATION UNIT
12. DATE OF BIRTH
13. PLACE OF BIRTH
14. NAME, RELATIONSHIP AND ADDRESS OF NEXT OF KIN
15. EXAMINING FACILITY OR EXAMINER, AND ADDRESS
16. OTHER INFORMATION
17. RATING OR SPECIALTY
TIME IN THIS CAPACITY *(Total)*
LAST SIX MONTHS

CLINICAL EVALUATION

NOR-MAL	*(Check each item in appropriate column, enter "NE" if not evaluated.)*	ABNOR-MAL
	18. HEAD, FACE, NECK, AND SCALP	
	19. NOSE	
	20. SINUSES	
	21. MOUTH AND THROAT	
	22. EARS—GENERAL *(Int. & ext. canals) (Auditory acuity under items 70 and 71)*	
	23. DRUMS *(Perforation)*	
	24. EYES—GENERAL *(Visual acuity and refraction under items 59, 60 and 67)*	
	25. OPHTHALMOSCOPIC	
	26. PUPILS *(Equality and reaction)*	
	27. OCULAR MOTILITY *(Associated parallel movements, nystagmus)*	
	28. LUNGS AND CHEST *(Include breasts)*	
	29. HEART *(Thrust, size, rhythm, sounds)*	
	30. VASCULAR SYSTEM *(Varicosities, etc.)*	
	31. ABDOMEN AND VISCERA *(Include hernia)*	
	32. ANUS AND RECTUM *(Hemorrhoids, fistulae) (Prostate, if indicated)*	
	33. ENDOCRINE SYSTEM	
	34. G-U SYSTEM	
	35. UPPER EXTREMITIES *(Strength, range of motion)*	
	36. FEET	
	37. LOWER EXTREMITIES *(Except feet) (Strength, range of motion)*	
	38. SPINE, OTHER MUSCULOSKELETAL	
	39. IDENTIFYING BODY MARKS, SCARS, TATTOOS	
	40. SKIN, LYMPHATICS	
	41. NEUROLOGIC *(Equilibrium tests under item 72)*	
	42. PSYCHIATRIC *(Specify any personality deviation)*	
	43. PELVIC *(Females only) (Check how done)* ☐ VAGINAL ☐ RECTAL	

NOTES: *(Describe every abnormality in detail. Enter pertinent item number before each comment. Continue in item 73 and use additional sheets if necessary.)*

(Continue in item 73)

44. DENTAL *(Place appropriate symbols, shown in examples, above or below number of upper and lower teeth.)*

Restorable teeth — *Non-restorable teeth* — *Missing teeth* — *Replaced by dentures* — *Fixed Partial dentures*

RIGHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	LEFT
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	

REMARKS AND ADDITIONAL DENTAL DEFECTS AND DISEASES

LABORATORY FINDINGS

45. URINALYSIS: A. SPECIFIC GRAVITY
B. ALBUMIN
C. SUGAR
D. MICROSCOPIC
46. CHEST X-RAY *(Place, date, film number and result)*
47. SEROLOGY *(Specify test used and result)*
48. EKG
49. BLOOD TYPE AND RH FACTOR
50. OTHER TESTS

88-117-02

Figure 2–3. SF 88, Report of Medical Examination, Page 1.

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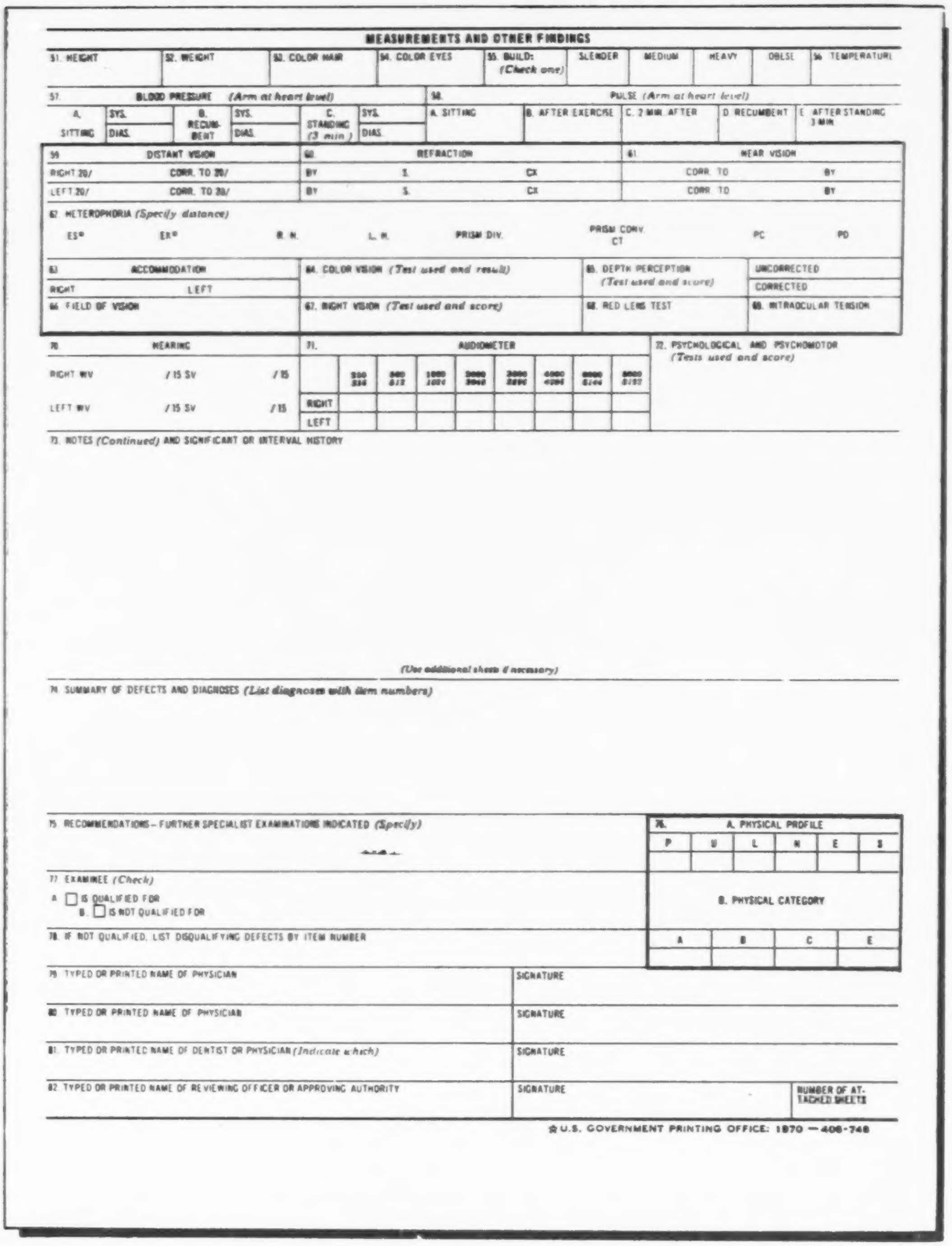

MEASUREMENTS AND OTHER FINDINGS

51. HEIGHT
52. WEIGHT
53. COLOR HAIR
54. COLOR EYES
55. BUILD: *(Check one)* SLENDER MEDIUM HEAVY OBESE
56. TEMPERATURE

57. BLOOD PRESSURE *(Arm at heart level)*

A. SITTING	SYS.	B. RECUMBENT	SYS.	C. STANDING *(3 min.)*	SYS.
	DIAS.		DIAS.		DIAS.

58. PULSE *(Arm at heart level)*
A. SITTING
B. AFTER EXERCISE
C. 2 MIN. AFTER
D. RECUMBENT
E. AFTER STANDING 3 MIN.

59. DISTANT VISION
RIGHT 20/ CORR. TO 20/
LEFT 20/ CORR. TO 20/

60. REFRACTION
BY S. CX
BY S. CX

61. NEAR VISION
CORR. TO BY
CORR. TO BY

62. HETEROPHORIA *(Specify distance)*
ES° EX° R. H. L. H. PRISM DIV. PRISM CONV. CT PC PD

63. ACCOMMODATION
RIGHT LEFT

64. COLOR VISION *(Test used and result)*

65. DEPTH PERCEPTION *(Test used and score)*
UNCORRECTED
CORRECTED

66. FIELD OF VISION

67. NIGHT VISION *(Test used and score)*

68. RED LENS TEST

69. INTRAOCULAR TENSION

70. HEARING
RIGHT WV /15 SV /15
LEFT WV /15 SV /15

71. AUDIOMETER

	250 256	500 512	1000 1024	2000 2048	3000 2896	4000 4096	6000 6144	8000 8192
RIGHT								
LEFT								

72. PSYCHOLOGICAL AND PSYCHOMOTOR *(Tests used and score)*

73. NOTES *(Continued)* AND SIGNIFICANT OR INTERVAL HISTORY

(Use additional sheets if necessary)

74. SUMMARY OF DEFECTS AND DIAGNOSES *(List diagnoses with item numbers)*

75. RECOMMENDATIONS – FURTHER SPECIALIST EXAMINATIONS INDICATED *(Specify)*

76. A. PHYSICAL PROFILE

P	U	L	H	E	S

B. PHYSICAL CATEGORY

A	B	C	E

77. EXAMINEE *(Check)*
A. ☐ IS QUALIFIED FOR
B. ☐ IS NOT QUALIFIED FOR

78. IF NOT QUALIFIED, LIST DISQUALIFYING DEFECTS BY ITEM NUMBER

79. TYPED OR PRINTED NAME OF PHYSICIAN — SIGNATURE

80. TYPED OR PRINTED NAME OF PHYSICIAN — SIGNATURE

81. TYPED OR PRINTED NAME OF DENTIST OR PHYSICIAN *(Indicate which)* — SIGNATURE

82. TYPED OR PRINTED NAME OF REVIEWING OFFICER OR APPROVING AUTHORITY — SIGNATURE — NUMBER OF ATTACHED SHEETS

☆ U.S. GOVERNMENT PRINTING OFFICE: 1970 — 406-748

Figure 2–4. SF 88 Report of Medical Examination, Page 2.

determine near visual acuity. Test each separately and determine the prescription that gives best acuity when near vision is less than 20/20. Record near visual acuity as a fraction with the numeral 20 as the numerator. When the same prescription corrects distance and near acuity, the entry following "by" should be "same." If there is a presbyopic correction, "same" is assumed, and you enter the amount of presbyopic corrections. For example, "+1.50."

Item 62. Heterophoria. Measure vertical and lateral phorias on all initial commission, flying training, and periodic flying physicals. Phorias are routinely measured at distance only. When phorias are measured on the VTA–ND, enter "VTA–ND (Far)" in the left hand margin near item 63. If you measure phorias on the 20-foot eye lane, enter "20" in the left hand margin. Enter the numerical results under the appropriate abbreviations. Do not record prism divergence, prism convergence, or pupillary distance. Record near point of convergence (PC) in millimeters (do not record the unit of measurement). Enter "Ortho" after "CT" when the eyes are orthophoric on the cover test. If deviaitons are noted, record the fact and enter the amount and character of the deviation in item 24.

Item 63. Accommodation. Required only on flying examinations. Use a Prince rule to measure near point of accommodation. Place the zero point of the rule 15 mm in front of the cornea. Place the accommodation card near the eye so that the patient cannot read it and slowly move the card away until the examinee can correctly read the 1 mm (0.62 or J2) print. Read the near point of accommodation (NPA) directly from the Prince rule in diopters and record it. (Dioptric values can be computed by dividing the near point in inches into 40, $D = \frac{40}{F}\ (\text{in})$, or the near, point in millimeters into 1000, $D = \frac{1000}{F}\ (\text{mm})$). If the examinee wears corrective spectacles, allow the patient to wear spectacles in this test.

Item 64. Color Vision. The standard screening test for color vision in the Vision Test Set, Color Vision (VTS - CV), also called Plate Set, Pseudoisochromatic, 15 plates. This set consists of one demonstration plate and 14 test plates in a ring binder. This test must be adminsitered under the easel lamp, listed as Light, Color Perception Testing. Any other light source alters the colors perceived by the examinee and renders the test results invalid. If the examinee cannot pass the screening test, test with the Vision Test Apparatus, Color Threshold Tester (VTA–CTT). The purpose of the VTA–CTT is to determine whether the examinee is color-safe for aviation. It has little or no value in determining the type of dewgree of color vision otherwise. If the examinee passes the screening test, the proper entry in this item is "VTS–CV Passes." If the examinee does not pass the screening test, enter "VTS–CV Fails," *the number of plates missed,* and record the score on the VTA–CTT in item 75. Congential color vision deficiency does not change throughout life. Once the degree of color vision deficiency has been established by careful testing, a repetition of the test is unnecessary. The entry "On Record" and the results of previous testing are sufficient, but be careful not to perpetuate invalid test results.

Item 65. Depth Perception. This item is required only on examinations for flying. The VTA–ND is the standard screening test for depth perception but is the most difficult for some examinees to pass, even though their fusion and depth perception are normal. Visual acuity less than 20/20 in either eye also makes the test very difficult or impossible to pass. If the Vision Test Apparatus is not available or if the examinee fails the standard test, the Verhoeff depth perception apparatus (DPA–V), or Howard-Dolman (H–D) are acceptable. Record in item 65 the name of the test used, the test results, and whether the eyes were corrected or uncorrected, in the spaces provided. On the VTA–ND, record results as "passes" through D, E, or F (whichever is applicable). Record the results on the DPA–V simply as "passes" or "fails," and record the result on the Howard-Dolman as the average error in millimeters on not less than five trials.

Item 66. Field of Vision. This is required only on exmainations for flying. A confrontation test is the routine test used to confirm a full field of vision. Have the examinee close left eye, hold it closed with the gentle pressure of a finger or two, and fix gaze on your left eye wile you close you right eye. Hold a plain white 1-cm sphere on a wire handle overhead and in a plane midway between the two. Keeping your hand out of the way, lower the sphere until the examinee sees it. Both you and the examinee should see the sphere simultaneously. Measure the extent of the visual field at 45° intervals. When the test for the right eye is complete, use the same technique to test the left eye. If, on the confrontation test, the field of vision appears to be constricted, of if you suspect a visual field defect, use the perimeter and the tangent screen for a more exact study. Record the results on DD Form 742, Clinical Record—Visual Field Examination. Record normal results as "Confrontation Normal."

Item 68. Red Lens Test. This test is required only on examinations for flying training. This test is intended to demonstrate diplopia that occurs not with central fixation, but with gaze shifted away from the central point. Seat the examinee 30 inches away from a tangent screen or other suitable fixation point approximately 48 inches above the floor. Place a filter, Diplopia Test, Red, before either eye. (The red lens is the standard trail lens set is not satisfactory.) Move a dim point source of light outward at least 20 inches from the center in the six cardinal directions of gaze and have the examinee follow the light with eyes while head remains stationary. The light should appear pink to the examinee. Instruct the examinee to report changes in the color (suppression) or a coupling in the light (diplopia). If suppression or diplopia develops, note the point on the screen at which it occurs and record it. Diplopia at extreme gaze is not unusual and not necessarily pathological.

Item 69. Intraocular Tension. Determine intraocular tension on all examinees 39 years of age or older. Palpation of the globes is nearly useless in determining whether intraocular tension is elevated. Use a calibrated Schiotz tonometer for the standard test. This instrument measures corneal indentability and offers a simple and satisfactory way to determine the approximate intraocular tension. You may also use a noncontact tonometer or an applanation tonometer on the slit lamp. A physician, optometrist, or technician who has received instruction in the proper performance and interpretation of the tests must perform this examination.

Item 74. Summary of Defects and Diagnoses. Summarize the defects that are considered to be significant or that require future consideration or evaluation (such as nonstatic defects that may become worse). Enter only the item number, followed by a short, concise diagnosis. Do not record unimportant and insignificant findings.

Item 75. Recommendations—Further Specialist Examinations Indicated. Specialist examinations and consultation reports to support this examination should not be reiterated in this item—they will have been done before the examination is considered complete. However, an entry, such as "Recommend ophthalmology evaluation every 3 months for elevated intraocular pressure," is appropriate. A waiver of defects may be requested or recommended in this item when there would be no compromise of safety, individual well-being, or effective duty performance on a worldwide basis. Usually, a note attached to the SF 88 is sufficient unless you are working in the physical examination section; then annotate the SF 88 directly.

Item 76A. Physical Profile. Make an entry on initial, periodic, and separation examinations. Retirement physicals do not require an entry. Segment 426 contains a detailed discussion of the Physical Profile Serial.

Item 77. Examinee Is Not Qualified For:

a. Entry and Special Duties. The examinee either is or is not qualified for the purpose for which the exam is given. Check the appropriate phrase and enter the purpose of the examination. Leave this item blank on US Service Academy and Flying Class 1 and 1A physicals. If the examinee has a valid waiver, enter "is acceptable with waiver for...." if no other disqualifying defects exist.

b. Worldwide service and continued active duty. Periodic examiantions address the examinee's qualification for general military service as well as their qualification for special duties (for example, flying, missile, air traffic control, etc.). If the examinee is found qualified for the special duty (either with or without a waiver), then their qualification for worldwide service is presumed. Medical standards for special duty are over and above those for worldwide service. In all other instances, identify the examinee as "qualified" or make the entry "qualification for worldwide service is questionable." The latter must be followed by sufficient evaluation for reviewing authorities to resolve the question.

c. Retirement and separation. Express the entry in item 77 in terms of worldwide service, even though the examinee's departure from active duty is imminent. An entry of "is" or "is not qualified for separation (or retirement)" is not appropriate since there are no medical standards for separation or retirement as such.

Item 78. If not qualified, list the disqualifying defect(s) by item number. Use item number only, not diagnosis. If qualified, enter a dash. In instances where qualification for worldwide service is questionable, list the item number of the defect in question.

Feigned Disorders of the Special Senses. Simulation of defective sight was common before the draft laws were repealed. There are no hard-and-fast rules for clarifying such pretenses, but the altertness and ingenuity of the examiner can successfully expose most of these deceptions.

Loss of vision. To verify complete loss of vision in one eye, place a 6^{Δ} prism, base out, before the "blind" eye. If diplopia is reported or if the blind eye moves inward to fuse the two images, both eyes have sight. Place a high plus lens (+16) before the good eye and a weak plus or minus lens before the blind eye. If the examinee can read a distant chart, vision in the blind eye is good. A projector, polarized light, or colored light, and appropriate filters before the examinee's eyes may be used to demonstrate that both eyes are seeing. The direct pupillary reflex test may also be used as a clue in many cases.

Diminution of vision. Prism tests are not applicable. Opthalmoscopic and retinoscopic examinations estimate refractive errors and rule out opacities. There is gross correlation between refractive error and visual acuity under cyclopegia. The use of weak lenses in front of the weak eye and at the same time a high plus lens before the good eye, or testing at different distances, can assist in determining true visual acuity. The examinee's occupation may have been such that it could not have been followed without more vision than he or she claims.

Dissimulation. Dissimulaton usually takes the for of concealed or distorted medical history, or memorized or learned test responses. Normal visual acuity and normal color vision are easy to fake if the examinee has memorized the correct responses. The test materials should be protected from study, and the examining techniques should ensure that examinees are not afforded an opportunity to benefit from the responses of those who precede them. Visual acuity charts and tests should be varied from time to time. Pseudoisochromatic plates should have their order of presentation changed periodically. The test plates in the VTS—CV can be memorized! There are other nonstandard tests that cannot be memorized, and these should be employed when there is a suspicion that the examinee is not seeing what is reported. Remember that many of the visual tests are entirely subjective and that erroneous responses are extremely difficult to detect. The responses to the phoria tests on the VTA—ND an be learned; failure to make an abnormal response on the red lens test could be considered a normal test. When there is a reason, be suspicious, be cynical, and use alternative tests to verify findings.

Exercises (617):

1. What are the two main points to observe and record in the pupils test?

2. What type of physical examination does NOT require a VA check?

3. What type of physical examination requires a cycloplegic refraction?

In exercise 4, answer each part and explain your answers.

4. Scott Sutton is referred from the PE section for a VA check for a periodic nonflying physcial. His unaided VA is 20/200, corrected to 20/20 by his glasses. He admits to being a contact lens wearer and states that he has left them out for three days prior to the examination. In this case, even though his aided acuity is 20/20, should you:

   (a) Have him return in 3 weeks for a recheck?

   (b) Record his VA as found?

   (c) Enter "contact lenses" in item 60 of the SF 88?

   (d) Enter the power of the contact lens in item 60?

The Flight Surgeon's office has misplaced its Prince rule target, and its NCOIC has asked you for a replacement. What size letters can you cut out of the standard test chart to use as a substitute?

5. When should you give the VTA—CTT?

6. Which visual field test is normally given on periodic flying physicals?

7. A patient has been referred to you from the physical examination section for a VA check. PE found OD 20/20, and OS 20/400. There is no previous history of poor VA or eye injury. Your VA check indicates OD 20/20, and OS 20/200 (the largest letter on your chart). Cover test is ortho, and color vision is normal, as is stereopsis. What would you suspect?

8. What should you do if contact lenses are found during your examination of a flying training applicant?

2-3. The Physical Profile Serial

The physical profile serial is a device that communicates an examinee's general physical condition to nonmedical personnel. For profiling purposes, human functions are divided into seven factors that are designated P (general physical status), U (upper extremities), L (lower extremities), H (hearing), E (eyes), S (psychiatric), and X (physical work capacity). The E profile considers only distant visual acuity; near visual acuity and color vision are not considered. The P profile accounts for organic eye diseases and visual field impairments.

618. Determine the E physical profile or simulated patients.

Physical Profile Grades. There are four grades in each of the seven factors. To assist in uniform recording of the E profile, use table 2-1 as a guide.

Suffixes. The physical profile serial uses three suffixes, which provide key identifying information to the Advanced Personnel Data System. One of these suffixes follows the profile of most individuals on active duty. Absence of a suffix implies the profile is permanent, in the sense of indefinite rather than irreversible.

W. The profile serial may be composed of all 1s or may contain 2s or 3s. However, the individual is considered to be physically qualified for immediate global deployment.

T. The profile serial contains one or more 4s, indicating the examinee is not considered available for worldwide service. However, the defect responsible for this grading is temporary and can be expected to resolve in less than 12 months.

L. The profile serial contains one or more 4s, and the defect is considered permanent. The examinee is not qualified for worldwide service, but is medically retainable IAW AFR 35–4, *Physical Evaluation for Retention, Retirement and Separation*, Chapter 6. The "L" suffix must not be entered unless authorized by AFMPC/DPMARA.

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TABLE 2–1
THE EYE PORTION OF PHYSICAL PROFILE

Profile Serial	Vision: Eyes
1	Minimum vision of 20/70 in each eye correctable to 20/20 in one eye and 20/30 in the other.
2	Vision correctable to 20/40 in one eye and 20/70 in the other, or 20/30 in one eye and 20/100 in the other, or 20/20 in one eye and 20/400 in the other.
3	Vision correctable to 20/40 in the better eye.
4	Distant visual acuity unless there is a defect listed as unacceptable in paragraph 4-7, AFR 160-43.
Factors to be considered.	a. Initial profile: (1) Enlistment. Below minimum standards for induction (AR 40-501). (2) Appointment. Below minimum standards for commission (AFR 160-43, chap 4). b. Revision of profile: all AF personnel: Medically unacceptable for worldwide service, including remote and isolated duty (AFR 160-43, chap 5). Use 4 profile only with "T" or "L" suffix for members on extended active duty and AFRES/ANG personnel eligible under AFM 35-4, chap 8.

Exercises (618):

Correctly profile the following eye findings.

	Uncorrected		*Corrected to*		*Profile*
	OD	*OS*	*OD*	*OS*	
1.	20/30	20/20	20/20	20/20	
2.	20/20	20/50	20/20	20/20	
3.	20/30	20/70	20/20	20/30	
4.	20/70	20/70	20/40	20/70	
5.	20/400	20/400	20/20	20/20	
6.	20/100	20/70	20/100	20/30	
7.	20/400	20/300	uncorr	20/20	
8.	20/400	20/100	uncorr	20/40	
9.	20/100	20/80	20/80	20/40	
10.	20/200	20/80	uncorr	20/40	
11.	20/100	20/80	20/70	20/50	

CHAPTER 3

Evaluation of Ocular Conditions

WEBSTER DEFINES "first aid" as "emergency treatment for emergencies . . . given before regular medical care is available." Most first aid books give little information on ocular first aid beyond recommending lavage and patching. As a specialist in the eye-care field, you should know some of the fundamentals of treating ocular trauma and be able to administer definitive first aid for the eyes.

3-1. Emergency/First Aid Treatment of Ocular Trauma

Although the primary mission of the optometry clinic involves problems related to the *healthy eye*, in the absence of an ophthalmolgy clinic, the optometry clinic frequently becomes the referral point for ocular emergencies. It is important for the optometry technician to acquire a knowledge of proper first aid procedures. Often prompt application of first aid treatment in an ocular emergency is the means of saving an eye or preserving the vision of the patient. The information provided below is designed to acquaint you with some of the more common ocular emergencies and their proper initial treatment.

619. Specify chemical eye injuries and the treatment of the injuries.

Chemical Trauma. There are many duties in the Air Force that require individuals to work around chemicals potentially hazardous to the eye. Chemical burns are exceedingly common from battery acid, cleaning fluids, and lime. In general, the immediate treatment for most chemical burns is prolonged irrigation with clean water or normal saline. We must stress the importance of the word "immediate" because it is not uncommon for a report to come to the optometry clinic by telephone that a chemical has been splashed into an eye. The optometry technician answering the call must be aware that treatment on the spot is absolutely necessary. The technician should instruct the patient to hold his or her eye open under a faucet or even put his or her face into a bucket of water, blinking the eyes rapidly. Sometimes the pain may produce blepharospasm making it very difficult for the patient to hold eyelids open during the irrigation without finger assistance. In order for irrigation to be effective, the eyelid *must* be held open.

Acid burns. Acid burns have a better prognosis than many other types of chemical burns. Acid burns do not penetrate the eye as do burns from alkali. Acid burns cause almost instantaneous local tissue destruction at the point of contact but do not penetrate the underlying tissue as readily as do alkalis.

The immediate treatment is irrigation. The eyelids should be held open. If the patient is in extreme discomfort, a drop of Proparacaine, Ophthaline, or Ophthetic can be instilled once and only once. Continue irrigation for 20 to 30 minutes. After the irrigation has been initiated and the patient somewhat stabilized, the patient should be transported to an ophthalmologist as soon as possible. If eye irrigation can be performed in the ambulance, it will be possible to get the patient into the hands of an ophthalmologist that much sooner. Because of the danger of adhesions, it is usually better to delay applying a bandage until the ophthalmological examination has been completed. At that time, an ophthalmic ointment will probably be applied and other appropriate therapy instituted.

Alkali burns (lye, etc.). Unlike acid burns, strong alkalis (bases) have a tendency to produce a sustained reaction with the ocular tissues. Progressive damage to the eye will continue until the alkali is removed by irrigation.

Immediate treatment is copious irrigation of the eyes for at least 30 minutes. It may be necessary to continue the irrigation for hours. The patient should be placed in the hands of an ophthalmologist as soon as practicable; however, irrigation must not be interrupted until the ophthalmologist says so.

Other chemical burns. Lime burns are common among plasterers and other construction workers. Initial emergency treatment is copious irrigation with water. Remove any particles of calcium from the conjunctival sac, if possible, and refer the patient to an ophthalmologist for follow-up care.

Refrigerator gases are also caustic to ocular tissues. Sulfur dioxide is used in some cooling plants or may be encountered as a pollutant from chemical or industrial processes. Sulfur dioxide burns should be treated the same as acid burns. Other referigerator gases include F–12 and F–14. F–12 and F–14 are insoluble in water; therefore, water irrigation is useless. Instead, use olive oil as your irrigator.

Tear gas or *mace* is frequently used in riot control. The concentrations used in riot control produce irritation, lacrimation, and blepharospasm. Recovery usually occurs in a short time. However, if a tear gas explosion accidentally occurs at short range, it is possible that the high velocity of the material at short range could cause the material to penetrate the eye with severe damage to lids and eyeball. Emergency treatment consists of irrigation. If available, irrigate with 0.4-percent sodium sulphite in glycerin or with glycerin alone.

Indelible pencil (aniline pencil) injuries are extremely dangerous. Aniline dye may cause blindness in a matter of days. Treatment consists of removing all particles of the pencil from the eye; then instilling a few drops of 2 percent sodium fluorescein solution every 5 to 10 minutes for at least 2 hours. The eye should be irrigated between applications of fluorescein.

Exercises (619):

1. Which is worse alkali or acid burns?

2. How are acid and alkali burns to be first treated?

3. With what should sulfur dioxide (refrigerator gas or atmospheric pollutant) eye burns be lavaged?

4. Freon refrigerator gas burns should be lavaged with what?

5. Specific treatment for tear gas burns includes lavage with what?

6. Indelible pencil particles in the eyes should be treated by removing the particles and instilling what?

620. Identify injury sources, symptoms, and treatments.

Radiation Trauma. Ocular radiation injuries may be incurred from many sources: furnaces, X-ray equipment, welding equipment, radioactive materials, radar transmitters, and the sun.

Ultraviolet (UV) radiation. UV radiation may be encountered from the sun or from sun lamps, mercury vapor lamps, electric welders, and similar equipment. "Snow blindness" is a term used for ultraviolet radiation damage to the eyes caused by the reflection of solar UV from large snow fields. Usually, UV damage has a latent period of several hours (just like a sunburn) and results in keratoconjunctivitis (an inflammation of the cornea and conjunctiva). The threshold dose for UV injury to ocular tissues is about twice that of skin (sunburn). Immediate treatment is symptomatic and usually consists of alleviating the pain with cold compresses. Certain drugs may further alleviate pain and prevent secondary complications. Most of the radiation burns seen as emergencies are due to ultraviolet rays.

Infrared (IR) radiation. IR radiation may be encountered from furnaces, heat lamps, electric heating coils, etc. Damage to the eye is usually deeper than that seen with UV burns. Although not encountered as an ocular emergency, prolonged exposure to IR radiation may result in cataract. The so-called "glass-blower's cataract," for example, is an occupational hazard of glass workers, occurring several years after chronic exposure to IR radiation. Eclipse burns of the retina may be seen as an emergency caused by gazing at the sun or a solar eclipse. There is a sudden loss of central vision due to the concentration of infrared rays on the macular area of the retina. Permanent blindness of the affected retinal area may result. Prognosis and treatment depend on the extent and severity of the burn; treatment is usually palliative. The threshold dose for ocular damage due to IR is below that for skin tissue.

Heat (flame) burns. If a person is burned about the face or eyelids from a fire, the eyelids usually close rapidly to protect the eyeballs. An actual burn of the ocular tissue should be treated in the same manner as an acid burn. The eyes may be covered with a sterile moist dressing before transporting the patient for specialized care.

Visible light. Most authorities agree that visible light does not damage the eye, although cases of retinal burns due to extremely high doses of visible light have been reported.

X-rays and gamma rays. The type of lesion experienced depends on the voltage of the X-ray machine and the portion of the eye affected. Soft X-ray (8–25 kv) may cause kertoconjunctivitis. The threshold for soft X-rays is about 1000 roentgens (r). Hard X-rays (100–1000 kv) cause cataracts after a dose of about 500–800 r, and they also cause keratitis after a latent period of several weeks. Radium (electron) burns may cause keratoconjunctivitis after a long latent period. The burns described in this paragraph are usually not in the province of first aid therapy.

Electric shock. Although not seen as an ocular emergency, electric shocks may cause a cataract after a very long latent period.

Exercises (620):

1. For each type of radiation injury in column A, match the possible source(s) from column B.

Column A	*Column B*
____ (1) Ultraviolet.	a. Heat lamps.
____ (2) Infrared.	b. Electric welder.
____ (3) X-ray.	c. Solar eclipse.
	d. "Snow blindness."
	e. Radiology equipment.

2. For each type of radiation injury in column A, select the most probably symptom(s) from column B.

Column A	*Column B*
____ (1) Ultraviolet.	a. Retinal burns.
____ (2) Infrared.	b. Keratoconjunctivitis.
____ (3) X-rays (hard).	c. Cataracts.

3. For each type of radiation injury in column A, select the first aid treatment from column B.

Column A	*Column B*
____ (1) Ultraviolet.	a. Palliative.
____ (2) Infrared.	b. None available.
____ (3) X-ray.	c. Symptomatic.

621. State the proper first aid treatment for a selection of mechanical injuries.

Mechanical Trauma. Mechanical trauma of the eyeball is an all too common event. Snowballs, baseballs, handballs, hockey pucks, etc., are common causes of blunt ocular trauma. Small metallic or carbon particles and glass are common foreign bodies in the eye. There is no end to the variations of mechanical trauma that one may encounter.

Lacerations and contusions. Lacerations of the eyelids may appear to be very serious, but if the eyeball is not involved, there will be no impairment of the patient's vision. However, lacerations of either the cornea or sclera may produce loss of sight.

When the eyelids are lacerated and the eyeball is not involved, bleeding may be controlled by a pressure dressing. However, if the eyeball itself is lacerated, pressure *should not* be applied to the eye because aqueous and vitreous would be displaced and irreparable damage done to the eye. The patient should be placed face up on the floor or table. Both eyes can be covered with a loose dressing to minimize the movement of the injured eye. The patient should then be gently placed on a litter for transport to surgery.

A common form of corneal abrasion is caused by wearing contact lenses too long. If a patient has worn contact lenses beyond the normal wearing time, shortly after removing the contact lenses a severe pain will develop in one or both eyes. The typical clinical picture is pain, lacrimation, and blepharaspasm. A drop of topical anesthetic is often necessary to facilitate examination. A fluorescein strip applied to the eye usually reveals diffuse corneal staining when viewed with the aid of magnification and a black light. A drop of antibiotic should be instilled and a firm patch applied after the patient has been examined by the doctor. Sometimes a drop of 2 percent homatropine is helpful in relieving the pain of ciliary spasm. The patient should see an ophthalmologist or optometrist for follow-up care before resuming the use of the contact lenses.

Sometimes the eye receives a blow that does not produce an abrasion but produces hemorrage in the interior of the eye. Bleeding in the anterior chamber (hyphemia) is sometimes evident. A difference in pupil size between the injured and noninjured eye is also often apparent. Although all cases of blunt injury should be referred to a medical officer, immediate treatment consists of making the patient as comfortable as possible after removing any dirt or foreign particles from the lids or eye. If there is considerable swelling of the eyelids, cold compresses should be applied to the affected area. If an eye is extruded after a severe injury, do not attempt to push it back in. Cover the eyes with a moist dressing and move the patient by stretcher for emergency treatment.

Foreign bodies (deep). Deep foreign bodies or foreign bodies that have penetrated in or around the structure of the eyeball are not always easy to diagnose. It is possible for a tiny particle of metal propelled at high speed to enter the eyeball or orbital structures with only a suspicion of its existence. An X-ray series of the skull is the easiest way to ascertain the presence of these particles.

If a large wound exists and the eye is leaking aqueous, immediately lay the patient face up and apply loose dressing to both eyes. Ready the patient for transport by litter for surgical help. Under no circumstances should you try to remove an embedded or penetrated foreign body. If a protruding foreign body exists, such as a pencil, a toothpick, a spear of glass, etc., again do *not* attempt to remove it. Instead place a cone or paper cup over that eye and tape the cup in place. Apply a loose dressing to the other eye as well before transporting the patient.

Foreign bodies (superficial). The treatment for superficial foreign bodies depends on the type of material present on the eye. A general rule is to irrigate the eye in an attempt to dislodge the particulate material. Inert foreign bodies—such as coal, glass, plastic, aluminum, and lead—frequently require no treatment if they are producing no discomfort. Reactive foreign bodies include iron, steel, copper, wood, and thorns. Removal procedures include irrigation, topical anesthesia, and use of a sterile, wet "Q-tip" or other implement. The cornea should not be stained before the foreign body is removed. If it is concluded that the material is embedded firmly in the tissue, refer the patient to a doctor who is knowledgeable in the ocular procedures required. An antibiotic and sometimes an anodyne may be ordered by the attending physician. Usually a firm dressing over the injured eye is ordered to help healing and to reduce discomfort.

Sometimes superficial foreign bodies lodge on the undersurface of the eyelids. Eversion of the lower lid to examine the conjunctiva is relatively simple. To evert the upper lid, have the patient look down, grasp the eyelashes with the thumb and finger of one hand and pull the lid gently away from the eyeball. At the same time, place an application stick horizontally midway across the outer surface of the lid, and pull the lid up and over the applicator. This will expose most of the conjunctival surface of the upper lid. Irrigation or use of a cotton-tipped applicator will facilitate the removal of any material that may be lightly embedded in the conjunctiva.

Exercises (621):

1. How would bleeding from lacerated eyelids be controlled?

2. The treatment in exercise 1 above should not be in what situation?

3. What may overwearing contact lenses cause?

4. A patient with a penetrating eye injury should be kept in what position?

5. Embedded foreign bodies in the eye (should) (should not) be removed immediately as a first aid measure.

6. How may most superficial foreign bodies be removed?

622. State the proper first aid treatment of other selected ocular emergencies.

Other Ocular Emergencies. Ocular emergencies other than those already mentioned include extreme eye pain and sudden loss of vision.

Acute eye pain. A symptom of this type is usually serious, and you should do little except refer the patient as soon as possible to a medical officer. However, one can suspect an attack of acute narrow-angle glaucoma when there is severe ocular pain. The pain often radiates towards the back of the head, and the patient may have nausea. Vision will be blurred due to a cloudy cornea, and the pupil will be dilated. The eye will appear inflamed and will feel hard on palpation because of the high intraocular pressure. If an ophthalmologist is not available and you and your optometrist are absolutely certain that the patient has acute glaucoma, 4 percent pilocarpine or 0.25 percent eserine salicylate should be instilled immediately and repeated every 15 to 30 minutes for several hours. Other systemic procedures should be started as soon as possible by a medical officer or ophthalmologist. Acute glaucoma should be differentiated from conjunctivitis, which is not nearly so painful and usually has a purulent discharge, and acute iritis, which has a contracted pupil and a muddy-looking iris. Acute glaucoma, conjunctivitis, and iritis all present a "red eye" and to that extent are similar. There are other ocular diseases that cause a painful eye and are not generally in your realm for first aid. Keratitis, inflammation of the cornea, displays itself as a red eye. The condition can be caused by a foreign body lodged in the cornea or a bacterial or viral infection of the cornea. keratitis is potentially very serious and very painful.

Sudden loss of vision. A sudden loss of vision is always a serious problem. There are several conditions that can cause a sudden loss of vision, but there are a few points that will aid in determining the actual cause of the visual loss. The rate at which the vision was lost and how vision disappeared can be important clues to the problem. Some of the more common causes of sudden visual loss are central retinal artery occlusion, central retinal vein occlusion, and retinal detachment.

Central retinal artery occlusion causes a rapid, profound, and painless loss of vision. It is caused by an embolus (blockage) of the central retinal artery (branch of the ophthalmic artery) before it branches to supply the superior and inferior retinas. If the emebollus occurs before the branching of the artery, there will be a *total* loss of vision. If the embolus occurs after the branching of the artery, the visual loss may be in the form of a hemianopsia, quadranopsia, or a small isolated field defect depending on the location of the blockage.

A central retinal vein occlusion is similar to an artery occlusion with a few exceptions. The onset of visual loss is slower in a vein occlusion than in an artery occlusion. The amount of visual field loss depends on the location of the thrombus (clot) and the damage from rupturing of tiny veinoles in the retina.

A third cause of sudden visual loss is retinal detachment. This occurs when the retina, for some reason (usually a hole or tear) pulls away from the choroid. Visual loss due to a retinal detachment can be either rapid or slow in onset. Classic symptoms include patient seeing a "veil" coming down over their vision, flashes of light, and numerous other symptoms (like specks of dust) in their vision. A detachment may affect all or just a portion of the visual field. People with a recent history of eye surgery or trauma are more likely to experience a retina detachment. These patients should be referred for immediate care.

One final note: it is not always possible to take a patient's visual acuity when the patient is in distress. However, where possible, record an estimate of the patient's visual acuity at the earliest opportunity, for this may have medicolegal significance later, especially in the case of civilian workers.

Exercises (622):

1. Match the phrase in column A with its appropriate word or phrase in column B. Each letter from column B may be used more than once.

Column A	*Column B*
____ (1) Extreme eye pain.	a. 4 percent pilocarpine.
____ (2) Acute GLC.	b. Refer to MD.
____ (3) Sudden loss of vision.	

2. What are three types of sudden vision loss?

3. Why should you take the VA on an eye emergency whenever possible?

623. Specify procedures and uses of the slit lamp.

Uses of Slit Lamp. According to Dr. Dwight D. Clark, the slit lamp should be used in all cases of red eye, ocular pain, sudden onset of blurred vision, and ocular trauma. It is an invaluable tool in the diagnosis of anterior segment eye disease, such as conjunctivitis, corneal trauma (abrasion) or foreign body, keratitis, iritis, angle closure glaucoma, and cataract. As a 5 level, you will do mostly preliminary evaluations, so not all situations indicated will be discussed.

Become familiar with the instrument. Learn location and operation of controls for adjustment of illumination, slit size and shape, magnification power, joy stick for focusing, filters. See figure 3-1.

Procedures. Position patient with chin on rest, forehead pressed lightly on forehead rest, and adjust height of rests for patient comfort. Turn light on lowest illumination, increase later, as needed. Set proper interpupillary distance of eye pieces on the microscope. Set magnification at a moderate level (10–15X). Set slit lamp angle at approximately 45° (30°–60° satisfactory). Adjust joy stick so that light is diffusely shining on eye.

The initial examination should be with diffuse illumination with the slit lamp width at its maximum. Observe conjunctiva and note pattern of injection. In conjunctivitis the palpebral conjunctiva is usually more injected than the bulbar; in iritis the reverse is true. Observe cornea for presence of foreign body.

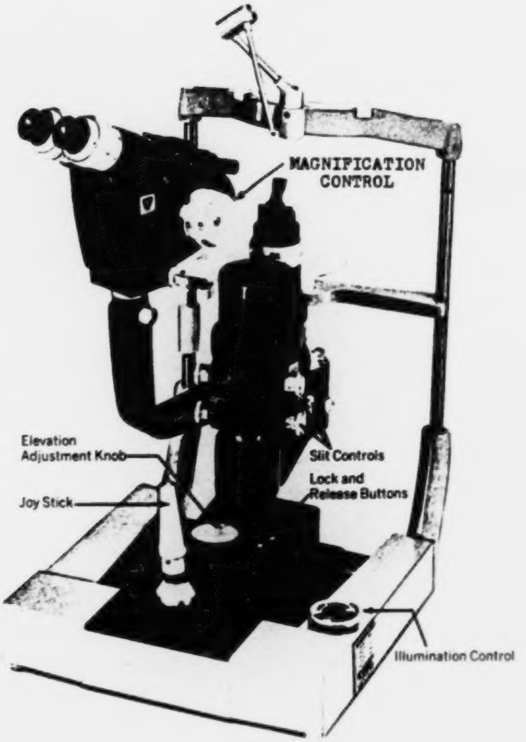


Figure 3–1. The Slit lamp.

Now focus on cornea and narrow slit width to form a parallelepiped (conic section). Scan cornea from nasal to temporal limbus looking for foreign bodies, corneal abrasions or scarring, (usually from contact lens overwear) or corneal opacities. Should corneal lesion be discovered and you wish to measure its depth, narrow the slit width to form optic section. Width of light becomes thickness of cornea. The depth of the lesion (epithelial, stromal, or endothelial) can then be determined.

Due to the fact that your use of the slit lamp will be limited, this is all we will discuss.

Exercises (623):

1. What can the slit lamp be used to diagnose?

2. The magnification should be set at what level?

3. The initial examination should be with what type of illumination?

3-2. Prevention, Recognition, and Disposition, and Use of Ophthalmic Drugs

When it is necessary to administer an ophthalmic drug, there are certain guidelines to follow for the benefit and safety of the patient. Having followed proper guidelines does not, however, preclude the possibility of an unexpected drug reaction. Therefore, it is necessary to recognize a reaction and to know what to do if an undersirable reaction occurs.

624. Specify the safe use and instillation of ophthalmic drugs.

Prevention. Probably the best prevention of drug reaction is to take a good case history. Inquire about any drug sensitivities the patient has experienced. Also ask the patient if he or she has glaucoma or any other ocular disease.

Look closely at the drug label. Read and re-read the drug label to ensure that it is the proper drug to administer. Then read it a third time before administering the drug.

Check the label date. If the drug has exceeded the date on the label, don't use it—discard it and get a fresh preparation.

Be aware that some drugs come in preparations that are for use on other parts of the body. Therefore, it is important that the word "OPHTHALMIC" appears after the description or name of the drug on the drug label. Only ophthalmic-quality drugs should be instilled in the eye.

Be aware of the precautionary information contained with the drug. For example, it is not advisable to use mydriatics and cycloplegics on glaucoma or preglaucoma patients; it is also generally not a good idea to use topical anesthetics on an inflamed eye. Know the other precautions.

Know what the correct dosage is for the results desired, and then administer only the minimum dosage required.

Immediately after instillation, systemic absorption of a drug is lessened somewhat if light pressure is applied over the lacrimal sac for a few seconds. This prevents drainage of the drug into the stomach by way of the nose and throat.

Finally, be sure that you know and understand your doctor's instructions before you administer the drug preparation.

Uses of Common Ophthalmodiagnostic Drugs. Because ophthalmodiagnostic drugs frequently affect pupil size, you should familiarize yourself with two terms relating to pupil size—"mydriasis" and "miosis." In mydriasis, the pupil is enlarged, and miosis is a constrected pupil. Some drugs are called "mydriatics," or "miotics," with respect to their action on the pupil. Some drugs produce both mydriasis and cycloplegia; these drugs are called cycloplegics. Cycloplegia is the state of the eye in which the ciliary muscle of the eye is paralyzed and the eye is unable to accommodate (focus). It is possible to have mydriasis without cycloplegia (depending on the drug used), but you cannot produce cycloplegia without mydriasis. You should remember that a cycloplegic is never used when all that is desired is mydriasis of the eye.

Mydriatics. Both phenylephrine and hydroxyamphetamine are mydriatics. They are frequently used when the doctor wishes to perform an ophthalmoscopic examination of the eye through an enlarged pupil.

Cycloplegics. The other group of drugs, which produce pupillary dilation but also produce paralysis of the ciliary muscle, will be listed next. These are the cycloplegics. They are not used unless cycloplegia of the eye is desired.

(1) Tropicamide (Mydriacyl), 0.5 to 2 percent. Actions and uses: Produces mydriasis and cycloplegia. Onset of action is rapid (20 to 30 minutes), and duration of action varies from 1/2 to 4 hours. May be used for cycloplegic refractions, especially when a longer acting drug would be inconvenient. Handy for use in Class 1 and 1A refraction.

(2) Cyclopentolate (Cyclogel), 0.5 to 2 percent. Actions and uses: Produces mydriasis and cycloplegia. Onset of action is rapid (20 to 30 minutes), and duration of action varies from 2 to 24 hours. Cyclogel is frequently used for cycloplegic refractions. Cyclogel probably produces more cycloplegic effect than Tropicamide, and is recommended by AFM 160–17, *Examination Techniques,* for use in Class 1 and 1A refractions.

(3) Homatropine HBr, 1 to 5 percent. Actions and uses: Produces mydriasis and cycloplegia, which may last up to 72 hours. Used frequently for cycloplegic refraction of children and for treatment of various ophthalmological conditions of the eye. Four percent solution is recommended for Class 1 and 1A refractions in AFM 160–17, but the long duration of effect is a disadvantage.

(4) Atropine, 0.5 to 4 percent (usually 1 percent). Actions and uses: Produces mydriasis and paralysis of accommodiation, which may last 2 to 3 weeks. Atropine is used mostly for refractions in small children where pronounced cycloplegia is desired by the doctor. It is also used for treatment of various other ophthalmological conditions.

Miotics. The last two drugs classified by their effect on the (ANS) are the parasympathomimetics. It is unlikely that you will use these much in the optometry clinic yourself, but you will see some patients with abnormally high intraocular pressure (glaucoma) who must use these drugs daily. Therefore, you should have a working knowledge of some of the parasympathomimetics.

(1) Pilocarpine HC1, usually 2 percent. Actions and uses: Produces miosis and stimulates accommodation. Pilocarpine is used in the treatment of glaucoma to increase the outflow of aqueous, thus lowering the intraocular pressure.

(2) Physostigmine salicylate (eserine), 0.25 to 0.50 percent. Actions and uses: Produces miosis and some spasm of accommodation. Physostigmine is also used to increase the outflow of aqueous to lower intraocular pressure in glaucoma patients.

Ophthalmic topical anesthetics. Another group of drugs that can be included in the category of ophthalmodiagnostic drugs, simply because they are used as an aid in performing diagnostic tests for intraocular pressure measurement, are the topical or corneal anesthetics. In order of perference, proparacaine HC1, benoxinate HC1, and tetracaine HC1 are three of the most commonly used anesthetics. Although you should coordinate the use of *any* anesthetic with the professional personnel in your eye clinic, at the same time you should be aware that tetracaine is not the anesthetic of choice for tonometry.

(1) Proparacine (Ophthaine or Ophthetic), 0.5 percent solutions. Proparacaine is a useful short term local anesthetic which is approximately equal to tetracaine in potency. The onset of analgesia is rapid, and the duration of action is about 20 minutes. Local instillation in the eye produces no serious side effects. Transient corneal edema may occur, but this is unusual. Sensitivity to this drug is extremely rare, therefore its the anesthetic of choice.

(2) Benoxinate (Dorsacaine), 0.4 percent solution. This is an effective local anesthetic. The onset of analgesia is rapid. Duration of action is approximately 20 minutes. The incidence of side effects is low, but there may be slight irritation following topical instillation. Mild superficial corneal edema may occur, but rarely. In patients with cardiac disease, thyroid disease, or allergies, this drug should be used with caution. The dosage is one drop in each eye approximately 2 minutes before tonometry is performed. For Schiotz tonometry, use a 0.4 percent solution. For applanation tonometry, a 0.4 percent solution combined with 0.25 percent of sodium fluorescein dye is frequently used.

(3) Tetracaine (Pontocaine), 0.5 percent solution. Tetracaine is a long-acting and surface-active local anesthetic. Tetracaine causes more allergic reactions than Proparacaine or Benoxinate. Topical use produces mild

irritation. Transient corneal edema may also occur. The drug is quite toxic. For tonometry, use one drop of 0.5 percent solution in each eye. (NOTE: Remember that anesthetics are toxic. If they are absorbed systematically from topical application, there is marked stimulation of the central nervous system, which could be serious to the well-being of the patient.) Also, caution the patient NOT to rub their eyes for at least an hour after the use of Benoxinate or Proparacaine. Remember that the cornea will be insensitive to pain and the patient could injure the eye while it is insensitive. Keep the patient under observation for 30 minutes and, if tonometry is performed. examine the cornea before dismissing the patient.

The use of a corneal anesthetic lowers the ability of the cornea to heal itself, so corneal anesthetics are not recommended to alleviate pain due to injury of the eye. A minor injury could become a dangerous ulcer.

Recognition and Disposition. Allergic hypersensitivity is the most frequent cause of drug reactions. A reaction to a drug dose which normally would be harmless is called a hypergic reaction. These reactions may vary from moderate swelling and redness to convulsions and death. Because of the wide range of clinical pictures possible, recognition of a drug reaction would be based on the degree and type of change the patient manifests as a result of the administration of a drug.

In case of a reaction, stop instilling the drug, recline the patient, and call a physician immediately. If a physician is not immediately available, obtain the assistance of the nurse or physician assistant until the physician arrives.

Safe Instillation of Ophthalmic Drops. Most patients who are going to be "dropped" are a little nervous—they may not understand what is going on and may be a little fearful of the procedure. Therefore, your first step is to reassure the patient. Explain what you are going to do and that it won't hurt, but it may sting for a couple of seconds.

The instillation of drops into the patient's eyes is a relatively simple thing to do; however, there are certain procedures to observe. Have the patient lean back in the examining chair and adjust the headrest so that the patient is facing upwards. Instruct the patient to look up. With the thumb of your left hand, pull down the skin of their lower eyelid, resting the thumb on the bony ridge under the eye. Place one drop of the ordered ophthalmic drop into the lower conjunctival sac, being careful not to let the top of the dropper touch the eye or eyelashes.Instruct the patient to close his or her eyes gently. Apply light pressure over the lacrimal sac and blot the excess medication from the lids with facial tissue. Repeat for the other eye.

The conjunctival sac holds only one drop. Thus, if an order for eye drops is written without specifying the number of drops, one drop is enough, unless it was not a "direct hit"; then a second drop should be instilled. Do not exert pressure on the eyeball. Do not allow the tip of the dropper to touch the patient. If the droper or bottle becomes contaminated, discard both.

Most patients tend to blink and squinch up when the drop strikes the eye. This tends to eliminate the medication from the eye before it has had a chance to do its job. To minimize the blink and possible elimination of the medication, retain control of the lid (or lids) for a couple of seconds after instillation. It is also a good idea to let the drop strike the lower conjunctival sac slightly temporal to the cornea. You can do this more easily by having the patient look to the left when you are dropping the right eye and to the right when dropping the left eye.

When attempting to instill ophthalmic drugs in small children's eyes, there is a method that will remove most problems. Simply lay the child back and ask the child to close both eyes. Put one drop of the ophthalmic drug in each medical canthus area. Have the child blink once or twice and you have the task completed with little or no fuss.

Exercises (624):

1. What is the best preventive measure to take against drug reaction?
2. What are some symptoms of a drug allergy?
3. What steps should you take in case of a drug reaction?
4. Usually how many drop(s) of medication are sufficient for an eye?
5. Where should medication be placed?
6. What is pupillary dilation called?
7. What is pupillary contriction called?
8. What are drugs that only dilate the pupil called?
9. What are drugs that both dilate the pupil and paralyze accommodation called?
10. What are the most common drugs used in a cycloplegic refraction of flying trainee applicants?
11. What is the most preferred corneal anesthetic?

CHAPTER 4

Classification of Contact Lenses

4-1. Contact Lens Strategy

Since a successful civilian contact lens practice is satisfying (and lucrative), many Air Force optometrists desire to maintain their proficiency by fitting contact lenses in the Air Force. Sometimes the establishment of a contact lens (CL) program bogs down in administrative quicksand; sometimes the inexperienced OD tries to fit contacts *on the side* and runs into trouble with both the hospital commander and the patients. This section is intended to give you a few tips on how to set up and operate CL service in the Air Force legally.

625. Compare contact lens administrative procedures for flying and nonflying personnel, which includes retired and dependents.

There are several ways in which a qualified patient may have contact lenses fitted at an Air Force installation. The first division of procedures is along the flying status versus the groundpounder line; the second is along the visually essential versus the cosmetic line.

Governing Regulations. Several medical and nonmedical regulations are concerned with the establishment of a contact lens service in your clinic. These regulations may be applied to all categories of patients requesting contacts.

Flying personnel. AFR 167–3, *Medical Services Opthalmic Services,* states that flying personnel are prohibited from using contact lenses unless these lenses are prescribed by the USAF School of Aerospace Medicine at Brooks AFB TX. Patients desiring this service must have their request and preliminary findings sent to USAFSAM for evaluation. Only *medically indicated* reasons will be considered.

Nonflying personnel. Nonflying personnel may be fitted with contact lenses under two different programs. The first program is designed for patients with ocular conditions that cannot be adequately corrected with glasses. These conditions include:

a. Monocular aphakia.
b. Bionocular aphakia.
c. Keratoconus.
d. Irregular astigmatism.
e. Aniseikonia.
f. Corneal scarring.

Other instances where contacts would be provided at Government expense are:

a. Where military duty is in a physical enviornment that precludes satisfactory performance of duty with glassses (prolonged exposure to sea spray, water vapor, or extreme cold).

b. When member is part of a recognized military drill or athletic team who competes at a national level.

Dependents and retired personnel. These individuals may be provided contacts at Government expense as long as it is part of an ongoing eye care treatment at a military medical treatment facility. Patients qualifying under these conditions may be fitted for contact lenses at any medical facility that has adequate personnel and equipment (see AFR 168–4, *Administration of Medical Activities,* Chapter 8, Section L). Payment for the lenses is provided according to AFM 67–1, *Preventive Maintenance Procedures and Serviceability Standards for Medical Equipment,* Volume V, Chapter 16. (Loosely interpreted, this means medical supply buys the lenses through local purchase channels, and bills your clinic accordingly.)

Patients who desire contact lenses for cosmetic reasons may also receive contact lens service from the optometry clinic under AFR 168-4. This regulation states that the patient pays the cost of the lens but the service is provided at no expense. In order to set up such services, observe the following steps:

(1) The OD or MD who will fit the contact lenses must be willing and competent.

(2) Ensure availability of necessary equipment and time.

(3) Write a letter for the hospital commander's approval, requesting establishment of a contact lens service.

(4) Arrange for contact lens lab services on a per case basis.

(5) Set up a collection agency using a nonappropriated fund, following the guidelines in *AFR 176–10, Financial Operations and Accounting Procedures.* The installation commander will have to approve this step. Either the hospital cashier or Central Base Funds can collect the money. This is normally the situation overseas only.

(6) Patients using this service hand-carry the lab RX to the cash collection point where they complete a purchase order. The lab should send the finished contacts to the clinic for final fitting. (NOTE: Before setting up an account for contact lens services, check the BX optical shop to see whether it offers a contact lens ordering service. It is a violation of regulations to set up a nonappropriated fund for contact lenses if the BX offers this service. In this case, the patient is given a prescription for contacts, which can be purchased at the establishment of their choice.)

Keep in mind that under no circumstances can we in the optometry clinic accept payment of any kind for the lens or services.

Exercises (625):

1. In exercises 1-4, match each item in column A with one or more responses from column B.

Column A

____ (1) Flying personnel.
____ (2) Drill team in national competition.
____ (3) Dependent with glasses that slip a lot.
____ (4) Military member who plays intersquad softball.

Column B

a. At Government expense.
b. At Brooks AFB.
c. Patient's expense.
d. Patient pays technician.

In exercises 2-6, indicate which of the following reasons for requesting contacts are considered to be *visually essential* and which are considered to be *cosmetic*.

2. Postcataract surgery.

3. Glasses too thick.

4. Need contacts for duty.

5. Swimming team member, competing locally.

6. Has kerataconus.

626. Specify the various components of a hard contact lens.

The use of proper terminology is important in any career field. Before investigating the lenses themselves, you should know what to call the various areas of a contact lens.

Hard Contact Lens Design. There are about as many contact lens designs and fitting procedures are there are practitioners; however, most hard contact lenses fitted today are one of the corneal types made of an inert plastic. These lenses may be fabricated as monocurve, bicurve, tricurve, multicurve, or *soft* lenses. Figure 4-1 shows monocurve, bicurve, and tricurve lenses.

In addition to the vertex power of a contact lens, several other variables must be considered to obtain a proper fit. Although these variables will be discussed individually, they are all interrelated so that changing one may necessitate changing another. These other interrelated variables are:

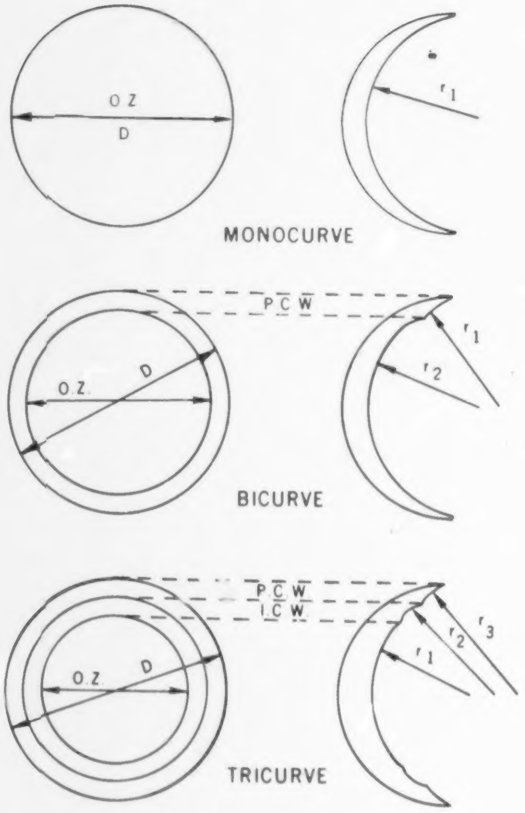


Figure 4–1. Hard contact lens types.

Base curve (BC). The radius of curvature of the optical zone, in diopters or millimeters.

Peripeheral curve radius (PCR). The radius of curvature of the most peripheral additional curve, usually the flattest curve (the one that has the longest radius), in diopters or millimeters.

Intermediate curve radius (ICR). The radius of curvature of the secondary additional curve in millimeters.

Blend curve, or blend (fig. 4-2). The radius of curvature of a tool used to smooth the junction between BC and IC or BC and PC, in diopters or millimeters.

Overall diameter (D). The total width of the lens in millimeters.

Optical zone diameter (OZ). The width of the central portion of the lens, containing the BC, in millimeters.

Peripheral curve width (PCW) and intermediate curve width (ICW). The widths of the secondary curves in millimeters.

Thickness (CT). Thickness of the lens through the central portion, in millimeters or inches.

Truncation. This modification (fig. 4-3) is used in an attempt to prevent the rotation of the lens whenever a toric prescription is used. The truncated portion of the lens is

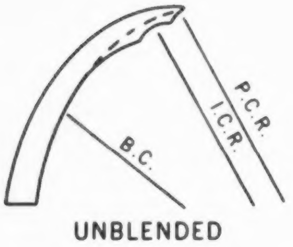


Figure 4–2. Relationship of BC, IC, and blend.

usually at the bottom but may be double—both at the top and the bottom.

Prism ballast. Another method of stabilizing a lens by grinding a prism to lower the center of gravity of the lens (fig. 4-4). This modification may be used with truncation.

Fenestration. One or more holes drilled in the lens to improve tear flow (fig.4-5).

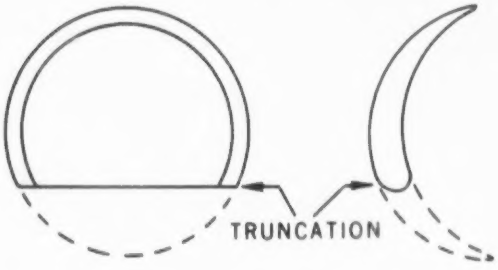


Figure 4–3. Turncated contact lens.

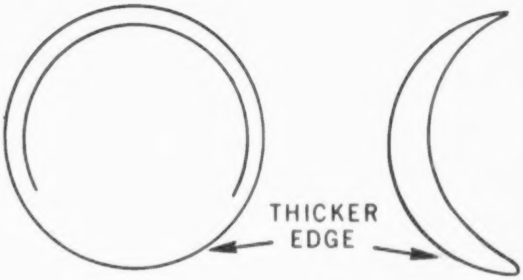


Figure 4–4. Prism ballast contact lens.

Special edge treatment. One of the most irritating features of a contact lens is a poorly processed edge. Most of the sensation caused by contacts is due to the edge striking or rubbing the upper lid. Many methods of contouring the edge have been developed in an attempt to reduce the lid irritation.

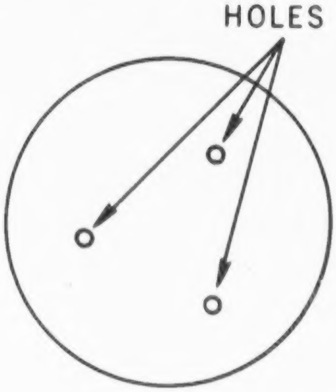


Figure 4–5. Fenestrated contact lens.

Exercises (626):

1. Identify the variables of a contact lens, shown in figure 4-6, by writing the name of each in the space provided.

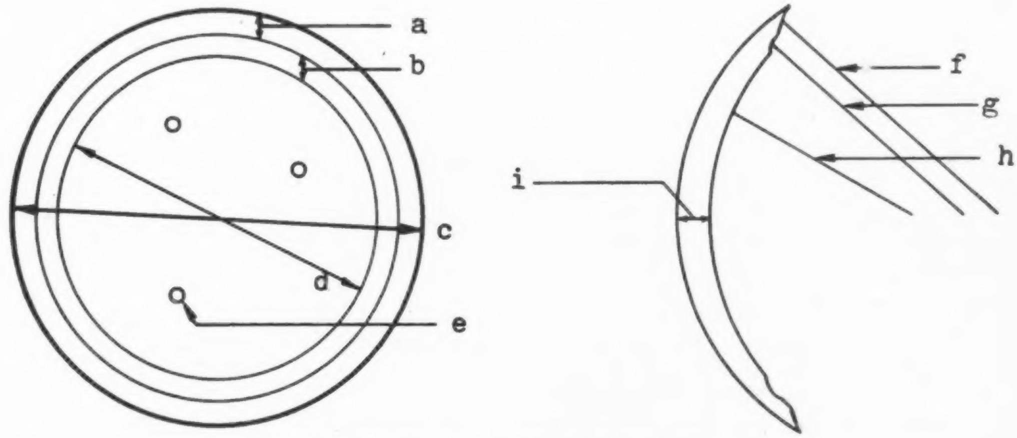


Figure 4–6. Contact lens (objective 626, exercise 1).

a.

b.

c.

d.

e.

f.

g.

h.

i.

627. Associate the variables found in a contact lens with the appropriate instrument used to measure those variables, and indicate the laboratory tolerances.

Contact Lens Verification. Most optometry clinics order the basic lens and subsequent modifications from the laboratory, although a few modifications can be done in the clinic. The basic lens and its modifications should be checked for accuracy using special contact lens inspection instruments described below.

Base curve (optical zone radius). This measurement is most commonly verified in the clinic by the keratometer and a special holder (as shown in fig. 4-7, A and B). The radiuscope is also used to verify base curves but it will be discussed later. Tolerance is ±0.03mm or ±0.12D. This is one of the most important variables to be verified.

Diameter. Diameter is measured with a diameter gauge or an inspection reticle (figs. 4-8 and 4-9). To use a diameter gauge, simply drop the lens in the wider end of the channel, and note where the lens touches the sidebar. This point is the diameter of the lens. Use the inspection reticle to measure overall diameter by holding the lens to the scale surface and comparing the edge of the lens to the scale markings. All contact lenses should be within ±0.05 mm of the diameter ordered.

OZ diameter. OZ diameter may be measured with the inspection reticle. The presence of a wide blend may cause your readings to be in error. The use of proper lighting to emphasize the highlights from peripheral curves is important. The tolerance is normally ±0.1 mm, or ±0.2 mm if a light blend is present.

ICW and PCW. These measurements are verified with the inspection reticle or a projection magnifier. A tolerance of ±0.05 mm is allowed. Blend measurements are difficult in the clinic, but may be estimated by using an inspection reticle.

Thickness. Thickness may be verified with a contact lens thickness gauge or with a lens clock. Since most clinics don't have a thickness gauge, try the lens clock method (fig. 4-10).

(1) *Zero* the clock on a flat piece of glass.

(2) Place the contact lens on the flat glass with the concave side up.

(3) Rest the clock on the lens so that the outside pins straddle the lens and the middle pin rests in the middle of the lens.

(4) Note the reading on the clock scale. Each diopter is approximately ±0.10 mm of thickness. The clock may be more accurately calibrated by feeler gauges similar to automotive valve clearance gauges. Be careful not to scratch the lens. The tolerance is ±0.02mm.

Edge. Edge treatment is extremely variable, and most labs don't maintain effective tolerances. The edge may be inspected with an inspection magnifier, slit lamp, or shadowscope.

Power. The power of a contact lens is verified with the lensometer in the same manner as you verify a spectacle lens. The lens is held against the nosepiece (use the special contact lens nosepiece to avoid warping the lens). The tolerance is ±0.25 with less than ±0.12 D unwanted cylinder and less than 0.25^{Δ} unwanted prism.

Exercises (627):

1. In exercises 1-7, match the contact lens variable in column A with the appropriate inspection instrument(s) in column B. Each letter may be used more than once.

Column A	*Column B*
____ (1) Base curve.	a. Diameter gauge.
____ (2) Overall diameter.	b. Inspection reticule.
____ (3) Optical zone diameter.	c. Keratometer.
____ (4) Peripheral curve widths.	d. Lensometer.
____ (5) Vertex power.	e. CL thickness gauge.
____ (6) Thickness.	f. Geneva lens measure.
____ (7) Edge treatment.	g. Slit lamp.
	h. Shadowscope or projection magnifier.

2. In exercises 8-15, match the contact lens variable in column A with the tolerance standard(s) in column B.

Column A	*Column B*
____ (1) Base curve.	a. ±0.02 mm.
____ (2) Overall diameter.	b. ±0.03 mm.
____ (3) Optical zone.	c. ±0.05 mm.
____ (4) Peripheral curve widths.	d. ±0.1 mm.
____ (5) Vertex power (sph).	e. ±0.12 D.
____ (6) Vertex power (cyl).	f. +0.25 D.
____ (7) Prism.	g. $\pm 0.25^{\Delta}$.
____ (8) Thickness.	

4-2. Composition and Discussion of Contact Lenses

With all that modern science has to offer, there has not yet been a perfect contact lens developed. With the advant

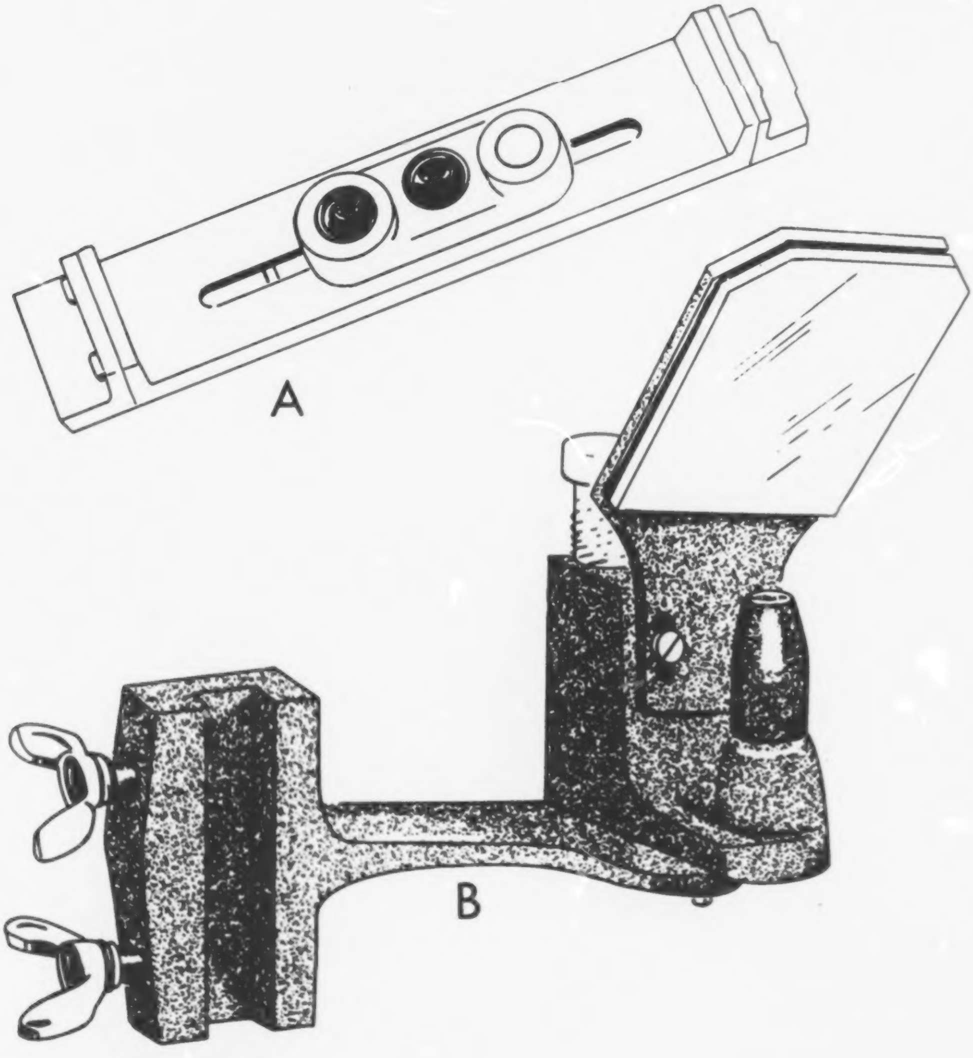


Figure 4–7. Contact lens holders.
A. Adhesive type
B. Fluid type

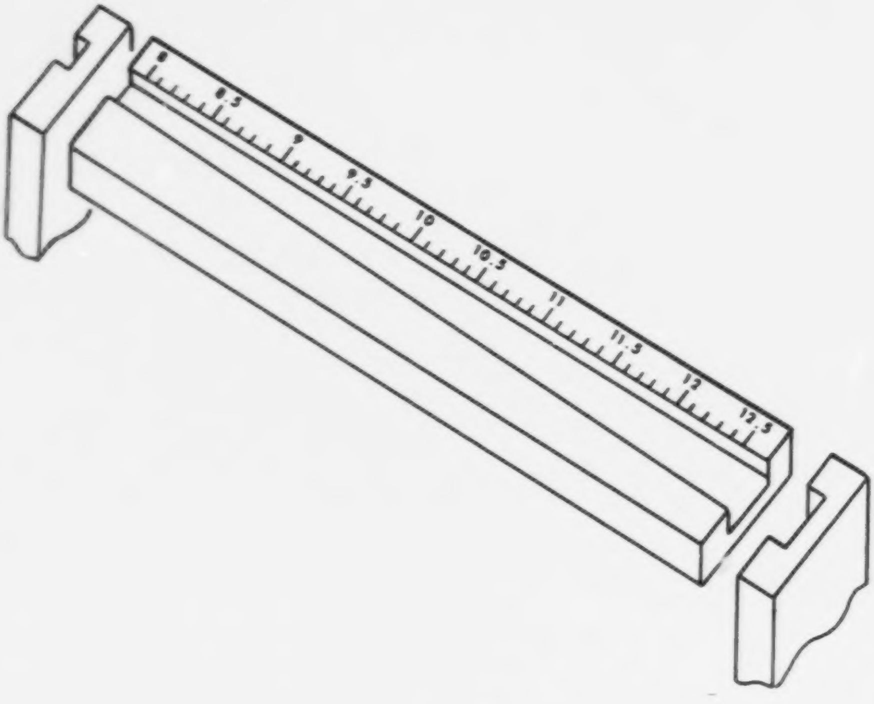

8
8.5
9
9.5
10
10.5
11
11.5
12
12.5

Figure 4–8. Diameter guage.

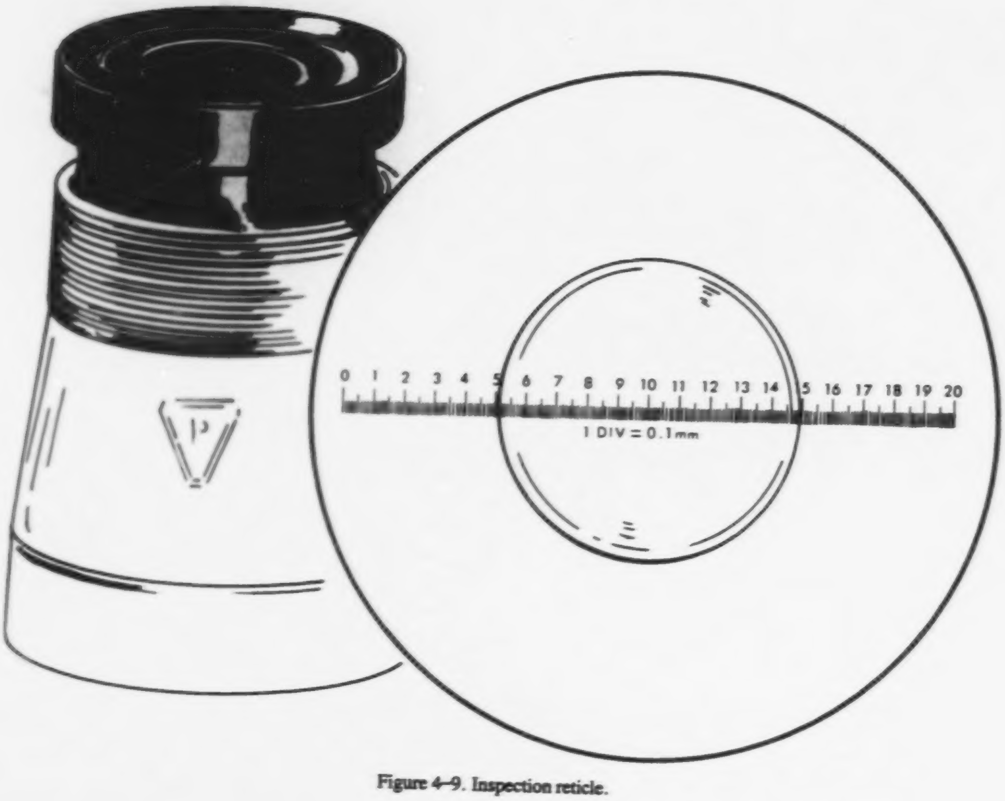

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1 DIV = 0.1mm
P

Figure 4–9. Inspection reticle.

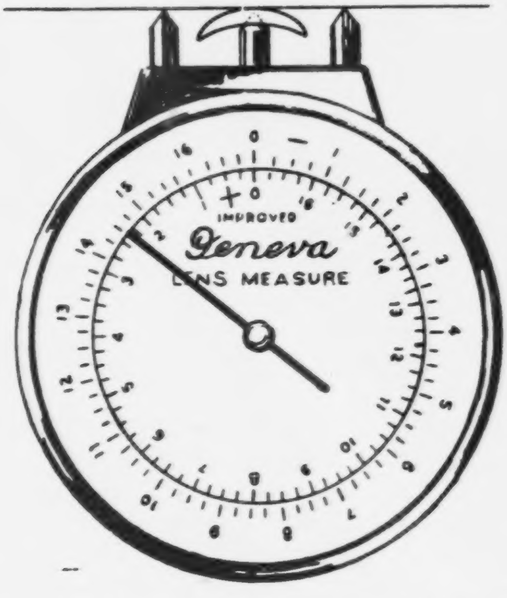


Figure 4-10. Lens clock method of measuring contact lens thickness.

of new materials with desirable charactertics we are coming close. Each type that has been developed over the years has its own distinctive advantages and disadvantages.

628. Specify the composition and advantages and disadvantages of hard contact lenses.

Hard Lens. Hard contact lenses were traditionally made of glass, however, in the late 1930's and early 40's a new plastic called polymethylmethacrylate was developed. This plastic, otherwise known as (PMMA), was found to have distinct advantages over glass and until just the past 15 years or so, has been the main contributor to contact lens material. Polymethymethacrylate (PMMA) is lighter, easier to shape, and much less susceptible to breakage than glass. Today, hard contact lenses are usually made of PMMA, but there are some other hard lens materials used. The lenses vary in hardness, but the manufacturer's main emphasis is on design characteristics, such as flexibility and thinness. According to recent findings among contact lens fitters, 75 percent fit initially hard lens versus 25 percent who initially fit soft. Some of the reasons for this could be in the advantages.

Advantages. The cost of hard lenses is significantly less than other types of lenses. This is especially true when it comes to replacement. The durability of the hard lens, when taken care of properly, is amazing. Some individuals have used the same lenses for as long as 15 years. Then there is ease of care in handling by both children and elderly, as well as everyone in between. This is primarily due to the smaller size (average range is 7.5-10 mm in diameter) enabling most to insert them, even those with narrow eye fissures, without much trouble. The ease of care comes with using the proper cleaning and wetting solutions, and in only a matter of minutes they are ready to wear. With proper preliminary measuring, the lens can sometimes be worn all day the first day. Probably the biggest advantage is the optics, which are usually better than spectacles, even for individuals who have moderate astigmatism.

Not all is bliss with the hard lens, so let's look at some disadvantages.

Disadvantages. As mentioned earlier, wearing them all day the first day is a sometimes situation. Usually there is a break-in period. This is for the eyelids to get used to sliding over the edge of the lens and for the cornea to get used to less oxygen and moisture due to reduced tear flow. They will break, during the cleaning process, if pressed too hard. This process could also flatten the lens, rendering it unusable. In cases where the patient has astigmatism, a problem known as "spectacle blur" will come into play. The patient's cornea conforms to the contact lens, so when removed, the cornea has to go through a readjustment period, during which, neither going without glasses or using glasses is of benefit. Another problem arises in dusty times. Because tears flow underneath lens, the dust and dirt are carried under too, causing some discomfort to wearer. Finally, during early wearing experience, the lenses tend to pop out more often than one would care ~~for them~~ to. This is usually due to more tearing during the adjustment period. Also, even with full adjustment and experience, they will pop out on occasions when the wearer looks to the side and blinks.

Exercises (628):

1. From what are most hard contact lenses made?

2. What is the main emphasis of the manufacturers?

3. What are four advantages of hard contact lenses?

4. What are four disadvantages of hard contact lenses?

629. Cite the method of care, insertion, centering and removal techniques as instruction for the patient.

Care. To preclude the possibility of infection or disease, certain rules of hygiene must be consistently observed. The hands should be thoroughly washed before handling or inserting contact lenses. A soap should be used that is free of cold cream, deodorant, or medication. Clean the lens with a contact lens solution commercially prepared for that purpose. This is done by placing a drop of the cleaning solution of the concave surface of the lens and then rubbing the solution onto both lens surfaces with thumb and first finger for a few seconds. Rinse the lenses with sterile water. Cleaning is necessary to remove any build-up of cosmetics or oily-secretions from the glands of the eyelid. Dirty lenses can produce discomfort and interfere with proper wetting. To wet the lens, use a commerically prepared contact lens wetting agent, place a drop on the lens and rub it over both surfaces. Rinse off the excess with irrigating solution or sterile normal saline. The lens is now ready for insertion. After removal, the contact lenses should be stored overnight in an approved soaking solution. Soaking solutions contain antibacterial agents. There are solutions available that are a combination of cleaning, wetting, and soaking solutions and can be used for each.

If the technician (or patient) performs the above procedures over a sink, the sink drain should be closed or covered with a towel to prevent loss of the lens if it falls into the sink.

Insertion. The patient should start with the right lens and should take special care not to confuse the right and left lenses. The best way to prevent this is not to remove the second lens from the contact lens until the first lens has already been inserted upon the eye. The contact lens case is clearly marked for right and left lens storage. After the lens has been cleaned and wetted as described, it should be placed on the longest finger of the dominant hand (convex surface on finger). With the other hand, the patient should grasp the upper lid by the margin to prevent blinking. With the third finger of the dominant hand the patient should hold the lower lid down while advancing the contact lens toward the eye. Using the third finger as a pivot, the patient can place the lens on the cornea. Control of the lids should be maintained for three or four seconds. The last step is to look downward and release the upper lid, then the lower lid.

Centering the lens. Occasionally a lens may slide off the cornea onto the sclera or be inadvertently placed onto the sclera during insertion. Remember the lens cannot slip behind the eye. The fornix conjunctiva prevents this. Locate the lens. Then, depending on the location of the lens, slide the lens onto the cornea by gently pushing or nudging the upper or lower lids with the fingers. There is usually enough tearing that the lens can be easily steering onto the cornea in this fashion.

Removal. there are two methods for removing contacts. They are the one-finger method and the two-finger method.

One-finger method. The lens must be on center before attempting removal. Again, start with the right eye. Look into a mirror and open the eye as wide as possible. (Startled appearance) Place the index finger or second finger at temporal canthus. Pull the canthus back toward the ear, while keeping the eyes wide open. Then blink hard and quick. The lens should be ejected by the lid margins. If not, blink again. The other hand may be used to catch the ejected lens.

Two finger method. Some patients are unable to remove the lens with the one one-finger method. Patients with small fissures or loose lids may do better by using two fingers to remove the lens. Place one finger on the lower lid and pull margin outward. This places the margin tight against the globe at the lower limbus. With one finger of the other hand, pull the margin of the upper lid outward to place the margin tight against the globe. Then flip the lens out with a scissors motion of the two fingers.

Exercises (629):

1. What is of utmost importance for a patient to know when preparing to handle the lenses?

2. What is the reason given to patients for cleaning the lenses?

3. During insertion, which side of the lens rests on patient's finger?

4. When centering, what portion of patient's anatomy should be used besides a finger?

5. How many methods of removal are there and what are they called?

630. Specify the modifications that can be performed in the clinic.

Lens modification. There comes a time, no matter how good the measurements are taken, that modification becomes necessary. This is usually because of lab error, a change in the patient's cornea, or an adjustment simply for comfort. Being able to make these modifications will give you several benefits such as:

a. Instant feedback without losingwearing time.

b. Improving rapport with patient by being able to do adjustments right in the office.

c. Improving the doctor's and technician's abilites and knowledge of contacts.

Again, there are some disadvantages which are mainly the time spent either by technician or doctor and the cost of the equipment may not be in your budget. Also, if you break the lens, you've then erased your benefits. Some of the modifications that can be accomplished in the clinic are:

a. Reducing diameter.
b. Enlarging bevel.
c. Changing edge configuration.
d. Blending junction of curves.
e. Changing power.

Exercises (630):

1. What are some advantages to be gained from modifying lenses in the clinic?

2. What are the modifications that can normally be done in the clinic?

631. State the procedures for disinfecting, inserting, and removing soft contact lenses.

Soft Contact Lenses. A very recent advantage in contact lens technology is the new soft contact lens. Since 1929, when a German by the name of Heine reported his success in substituting contact lenses for spectacles, contact lenses have been made of hard material. Until 1938, contact lenses were made of glass. By 1939, with the development of methyl methacrylate plastics, plastic had gained almost universal acceptance. However, patient discomfort and other factors greatly limited the number of individuals who could tolerate contact lenses made of these hard materials. There are indications now that the new soft contact lenses should greatly increase the number of people who can be fitted with contact lenses.

In the early 1970's, a new soft contact lens was approved by the Federal Drug Administration (FDA). The Bausch and Lomb (B & L) Soflens was the first lens approved, but since then many lenses have become available. The main advantages soft lenses have over hard lenses are that they are extremely easy for the patient to adapt to. Also, they don't tend to alter the corneal curvature; therefore, patients can wear spectacles part time with no blurring of vision. The main disadvantages are that they don't tend to be able to correct as much corneal astigmatism as hard lenses, they are slightly more difficult to care for, and they have a relatively shorter life than hard lenses.

Soft lenses are hemispherical shells of approximately 13 mm diameter on the average. They are composed mainly (61.4%) of a substance called hydroxethylmethocrylate, thus the knidsnome (HEMA) lenses. A large percentage of the lens is made up of water (38.6% in the B & L Soflens) and because of this, the lens will absorb water readily. This is not to say that the B & L are the only soft lenses; the others have different percentages of water absorption. The lenses have the characteristic of being able to pass water and gasses through them allowing the cornea to more readily maintain its normal physiology. This could be a disadvantage also because unwanted substances like bacteria and noxious fumes could also pass into the lenses.

Soft lenses are either spun cast or cut on a lathe with a particular inside curvature. Because this curve is not spherical, we can't call it the base curve but rather the *posterior optical radius* (PAR). The power of the lens is determined by the relationship of the front curve to the back curve just as in any lens. As mentioned before, soft lenses are much larger than hard lenses with an average *diameter* of 12 to 13 mm. Because they are so large, they overlap the cornea and limbus and the peripheral portion of the lenses ride on the sclera. A *peripheral curve* is ground on the lens which is greater than the PAR so that the lens fits on the sclera better. The central area of the lens that does not have the peripheral curve ground on is called the *optical zone* of the lens and is the portion that the patient sees through. The *thickness* of the lens, like hard lenses, refers to the thickness of its center expressed in parts of a mm. (See fig. 4-11). The thinner the lens, the more water and oxygen can pass

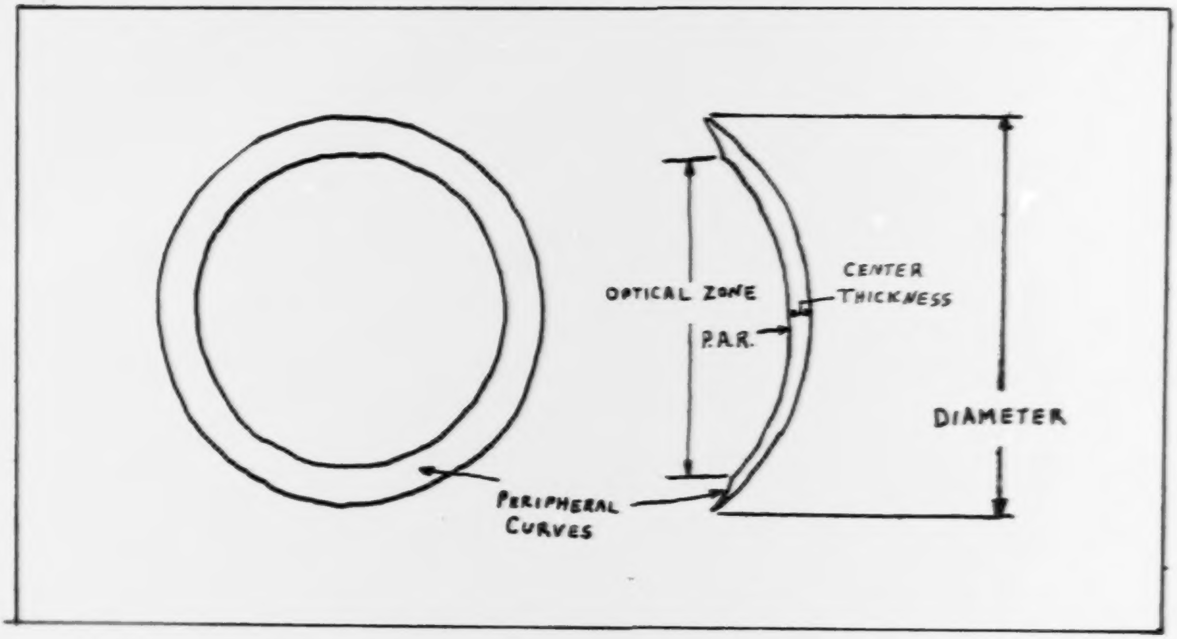


Figure 4-11. Soft contact lens nomenclature.

through it. At the present time, soft lenses are not being tinted. When ordering soft lenses, they are usually specified by power, diameter, and PAR: all other lens parameters are usually precalculated. Soft lenses are supplied in a glass vial immersed in sterile saline solution. Each vial shows the manufacturing lot number and the dioptric power of the lens, (plus lenses have black numbers and minus lenses have red numbers). Some companies' vials contain the PAR and diameter on the label also.

Disinfection. Because soft lenses tend to absorb bacteria and other unwanted substances, it is imperative that they be cleaned and sterilized daily. Only approved cleaning, soaking, and disinfecting solutions should be used on soft lenses. Hard lens solutions should never be used! Daily disinfection may be accomplished by either a heat sterilization method or a chemical sterilization method. Once one method is begun, they should not be switched. Whatever disinfection method is used, the lenses should first be cleaned. This is done by placing the lens in the palm of the hand, putting a few drops of an approved cleaning solution on the lens and rubbing it with the finger of the other hand. Then it is rinsed with an approved rinsing solution. If a heat disinfection method is used, the lenses are placed in a case in normal saline and the whole case is placed in an aseptor unit. A button is then pushed, and after 30 to 40 minutes the lenses are sterilized and ready for wear. There are presently two types of aseptor units, one that requires distilled water and a new type that uses dry heat. If an aseptor unit is not available, the lenses may be boiled in water for about 15 minutes. Normal saline should be made fresh daily by dissolving salt tablets in distilled water. Sterile unit doses of saline are also commericially available. If a chemical disinfection method is employed, the lenses are placed in a case filled with an approved chemical disinfectant after cleaning, and soaked for a minimum of 4 hours. After rinsing, they are ready for wear. It is recommended that weekly cleaning be accomplished using an enzymatic cleaner to remove protein deposits and keep the lenses from yellowing. Because soft contact lenses can absorb substances, some of which are potentially harmful to the eyes or to the lenses themselves, there are certain precautions that are necessary:

a. For storage, use only normal saline solution or disinfecting solution.

b. Never use fluorescein while the patient is wearing soft lenses or within one hour before lenses are to be inserted.

c. No medicants, ophthalmic solutions, or conventional contact lens solutions can be used.

d. Soft contact lenses must be removed before swimming.

e. They must be removed in the presence of noxious and irritating vapors.

f. If there is any possibility that the soft lenses have absorbed a substance that could be harmful to the eye, they should not be be worn.

g. Normal saline should be made fresh daily.

h. Uses distilled water to make saline, not tap water because it contains impurities.

Insertion and Removal Technique. The procedures for inserting and removing lenses are as follows:

Insertion. After the lenses have been cleaned and rinsed as previously mentioned, they can be inserted onto the eye as follows:

(1) Make sure the lens is not inside out. The taco test is shown in figure 4-12.

(2) Place the moistened lens on the index finger of the dominant hand with the convex side toward the finger.

(3) Pull the lower lid down with the middle finger of that hand or the other hand.

(4) Look up and keep the eye still.

(5) Place the lens on the lower sclera.

(6) Remove fingers and look down.

(7) The lens should center itself; if not, close the eye and massage to center.

Removal. Use the following steps for removing soft contact lenses:

(1) Hold the lower lid down with the middle finger of the nondominant hand.

(2) Make sure the lens is on center.

(3) Lightly place the tip of the index finger on the center of the lens surface.

(4) Look up and at the same time slide the lens down onto the lower sclera keeping the index finger on the lens.

(5) Gently pinch the lens between the thumb and index finger and pull the lens away from the eye.

Exercises (631):

Indicate which of the following statements concerning soft contact lenses are true and which are false. Explain false replies.

T F 1. Any conventional contact lens solution may be used to soak and clean the lenses.

T F 2. The soft lenses are better for swimmers than are the hard lenses.

T F 3. Soft lenses should be boiled for at least 15 minutes daily or chemically disinfected for a minimum of 4 hours.

T F 4. Eye drops may NOT be used when wearing soft lenses.

4-3. The Keratometer or Opthalmometer

In the previous liter,ature of this chapter you have been told the history of contacts, current information on them, care and handling. This unit is going to show and explain the method used to obtain the measurements necessary to determine which lens will fit.

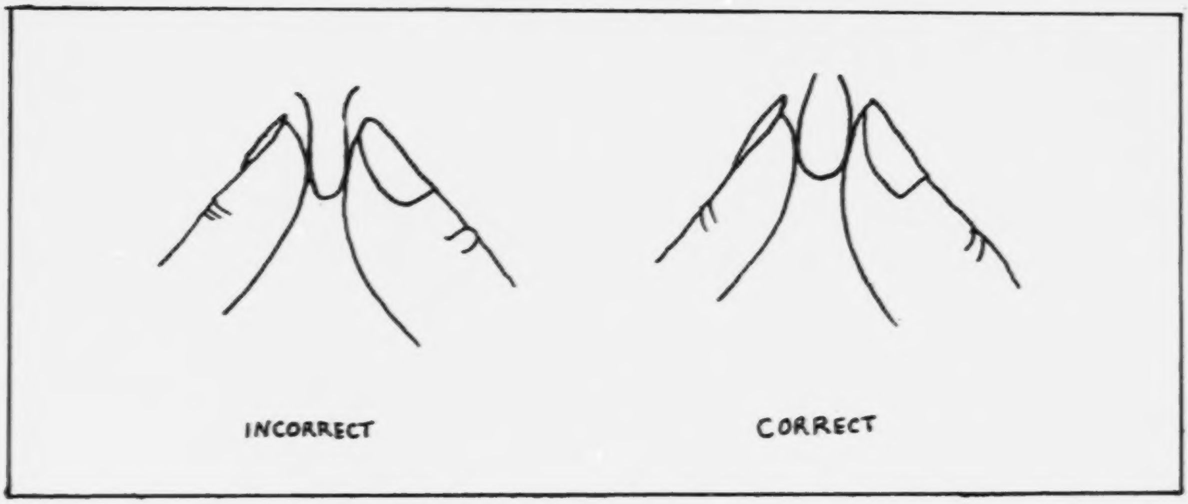


Figure 4-12. "Taco" test for soft lens.

632. State the procedures for using the keratometer or opthalmometer properly.

The Keratometer (fig. 4-13). The keratometer (B & L) or ophthalmometer (AO) is used both to measure the surface curves of the patient's cornea and to verify the base curve of the contact lens. These instruments work on the principle that the cornea acts like a convex mirror, and the instruments use the reflected images of special targets to estimate the corneal curvature. The principle is similar to lensometry, but the keratometer has an image-doubling system in addition to the telescope and illuminated target.

Eyepiece adjustment. To use the keratometer, first focus the target cross by placing the white movable occluder in front of the illuminated barrel and adjust the eyepiece in the same way that you adjust the lensometer eyepiece, focusing the black cross.

Patient position. Next, align the patient's head in the headrest and occlude the left eye. Manually adjust the keratometer height so that it is level with the patient's eye. Adjustment of the chin and forehead rests may be necessary, but use of the elevating knob is usually sufficient.

Instrument focus. Now look through the eyepiece while the patient fixates the mirror at the back of the *gunbarrel*. The patient should see a reflection of his or her own eye, and you should see an image similar to figure 4-14.A. Adjust the keratometer so that the cross is in the center of the lower right circle. Adjust the focusing knob so that the lower right circle is single. Adjust the axis barrel so that the horizontal meridian marker is (180°).

Cylinder axis location. Turn the horizontal power drum so that the two bottom middle (+) signs approach each other as in figure 4-14,B, and rotate the axis barrel until the line is straight. When the horizontal lines appear tip to tip, as in figure 4-14,C, the instrument is set at the corneal axis of astigmatism. If the lines are discontinuous, as in figure 4-14,B, rotate the axis barrel until the line is straight. When the horizontal lines appear tip to tip as in figure 4-14,C, the instrument is set at the corneal axis of astigmatism.

Horizontal meridian power. Now turn the horizontal power drum so that the plus signs overlap, as in figure 4-14,D. The scale now indicates the power of the principal horizontal meridian in diopters.

Vertical meridian power. If the cornea is astigmatic, the minus signs may be doubled when the plus signs are in focus. Readjust the focus knob so that the minus signs are single. Now rotate the vertical power drum (right-hand knob) so that the minus signs are superimposed. This drum now indicates the power of the vertical principal meridian in diopters. (NOTE: During all power readings, keep readjusting the focus knob so that the symbol of the meridian being measured is kept single.)

Recording the readings. Look at the values indicated on the power drums. If they are equal, the cornea is spherical, and may be recorded as such; for example, OS 44.25 D sph. If and the readings differ, the cornea is astigmatic. Record the power in each axis by writing the value of the horizontal drum in the horizontal meridian as indicated by the left-hand indicator on the axis drum, and the vertical power in the vertical meridian as indicated by the top indicator (similar to an optical cross).

Example: OD 44.50 D in 165
45.00 D in 075

To find the approximate correcting minus cylinder, subtract the smaller value from the larger and write this difference using the axis of the weaker meridian.

Example: 45.00 − 44.50 = 0.50 D X 165
(approximate correcting minus cylinder power and axis.)

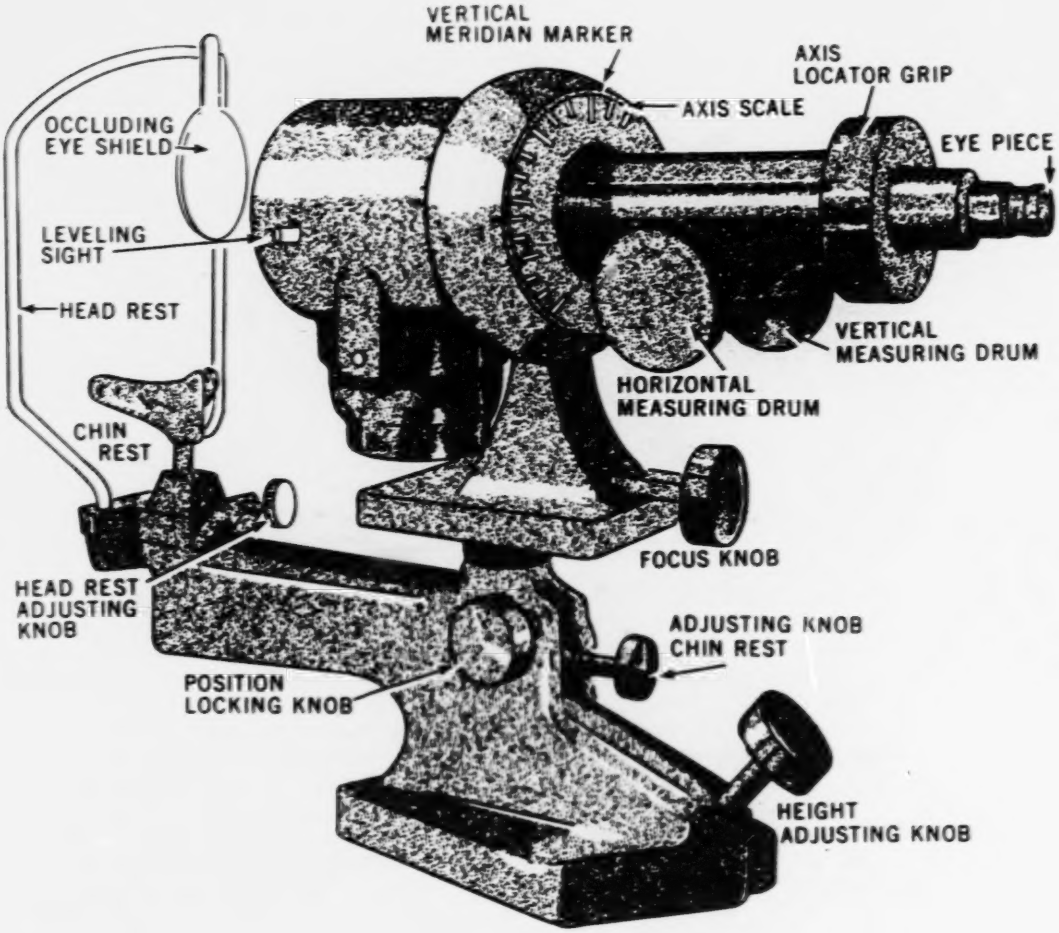
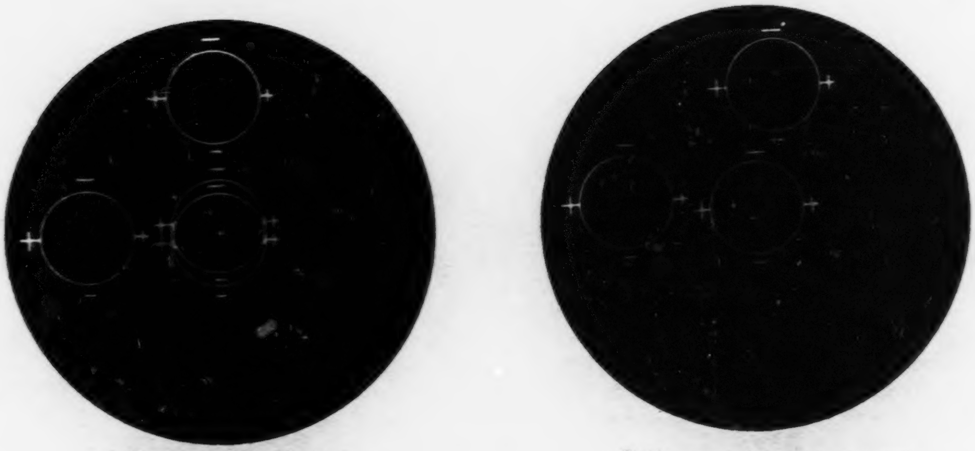
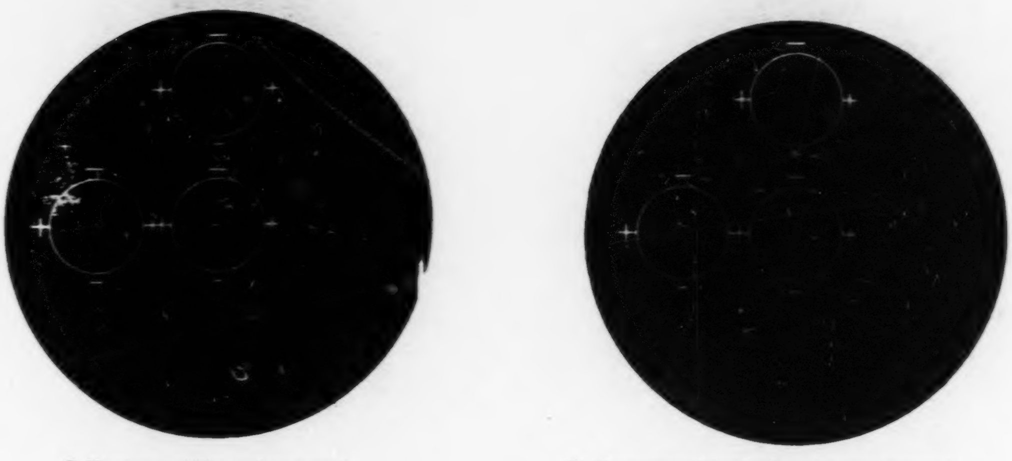

VERTICAL MERIDIAN MARKER
AXIS LOCATOR GRIP
AXIS SCALE
EYE PIECE
OCCLUDING EYE SHIELD
LEVELING SIGHT
HEAD REST
VERTICAL MEASURING DRUM
HORIZONTAL MEASURING DRUM
CHIN REST
FOCUS KNOB
HEAD REST ADJUSTING KNOB
ADJUSTING KNOB CHIN REST
POSITION LOCKING KNOB
HEIGHT ADJUSTING KNOB

Figure 4–13. The Bausch and Lomb Keratometer.



A. Keratometer Mires-first look

B. Keratometer Mires-astigmatic eye



C. Keratometer Mires-axis corrected

D. Keratometer Mires-horizontal power corrected

Figure 4–14. Adjustment of Keratometer

The following terms are used in referring to the axis of astigmatism:

- If the meridian of most power is between 0° to 30° or 150° to 180°, the astigmatism is "against the rule."
- If the meridian of most power is between 60° to 120°, the astigmatism is "with the rule."
- If the meridian of most power is between 30° and 60° or 120° and 150°, the astigmatism is "oblique."
- If the mires are undistorted, the astigmatism is "regular," while distorted mires indicate "irregular astigmatism."

Calibration of the keratometer. Sometimes, because of mishandling, the keratometer slips out of adjustment, or you might possibly want a method of checking your accuracy without using a patient. One method of doing this to to local-purchase a steel test ball. Most contact lens supply houses offer a highly polished, reflective steel ball of about 7.58 mm radius, which indicates a 44.50 D sphere of the keratometer. If you consistently get readings that differ from the true radius of your steel test ball, you may recalibrate the keratometer by loosening the setscrew located in each power drum shaft, then rotating the power drum to the correct reading, and retightening the setscrew. Any further adjustments or calibration must be done by the manufacturer.

Measuring contact lenses. You may use the keratometer to verify the BC of a contact lens by attaching a lensholder (refer again to fig. 4-7,A and B). Since the keratometer is adjusted for convex surface readings, a correction factor must be included when measuring concave BCs. Table 4-1 will convert a dioptric reading as indicated on the power drums to millimeters of radius, when you are measuring either a concave or convex surface.

Exercises (632):

1. What is placed in front of the illuminating barrel on the karatometer when first focusing?

2. Calibration of the eyepiece is done with the aid of what?

3. When you are using the keratometer, align the instrument so that the cross is in which circle?

4. Cylinder axis and horizontal cylinder power are measured by observing what and recording the reading on which power drum?

5. Which circle must be kept single during all measurements?

6. Vertical cylinder power is measured by observing what and recording the reading on which drum?

7. Where is the cylinder axis shown?

633. State the procedures for using the radiuscope.

The radiuscope is the other instrument that is used to verify the BC of a hard contact lens. It may be also used to check fenestrations and the general optics of the lens. Some clinics that do a large number of contact lens fittings will probably have a need for this instrument. It is much easier to use, especially for a technician, than the methods described earlier.

Radiuscope. Figure 4-15 is a typical radiuscope. The procedures for using it are as follows:

(1) Clean the lens thoroughly, otherwise you may pick up distortion.

(2) Add saline solution or other wetting solution into groove or notch situated in the lens mount.

(3) Place lens, concave surface up, on the lens mount.

(4) Absorb excess fluid with tissue.

(5) Turn power on.

(6) By turning the coarse adjustment knob towards you, a line star (real image) will come into focus (fig. 4-16); this will probably require some adjustment using the fine focus knob.

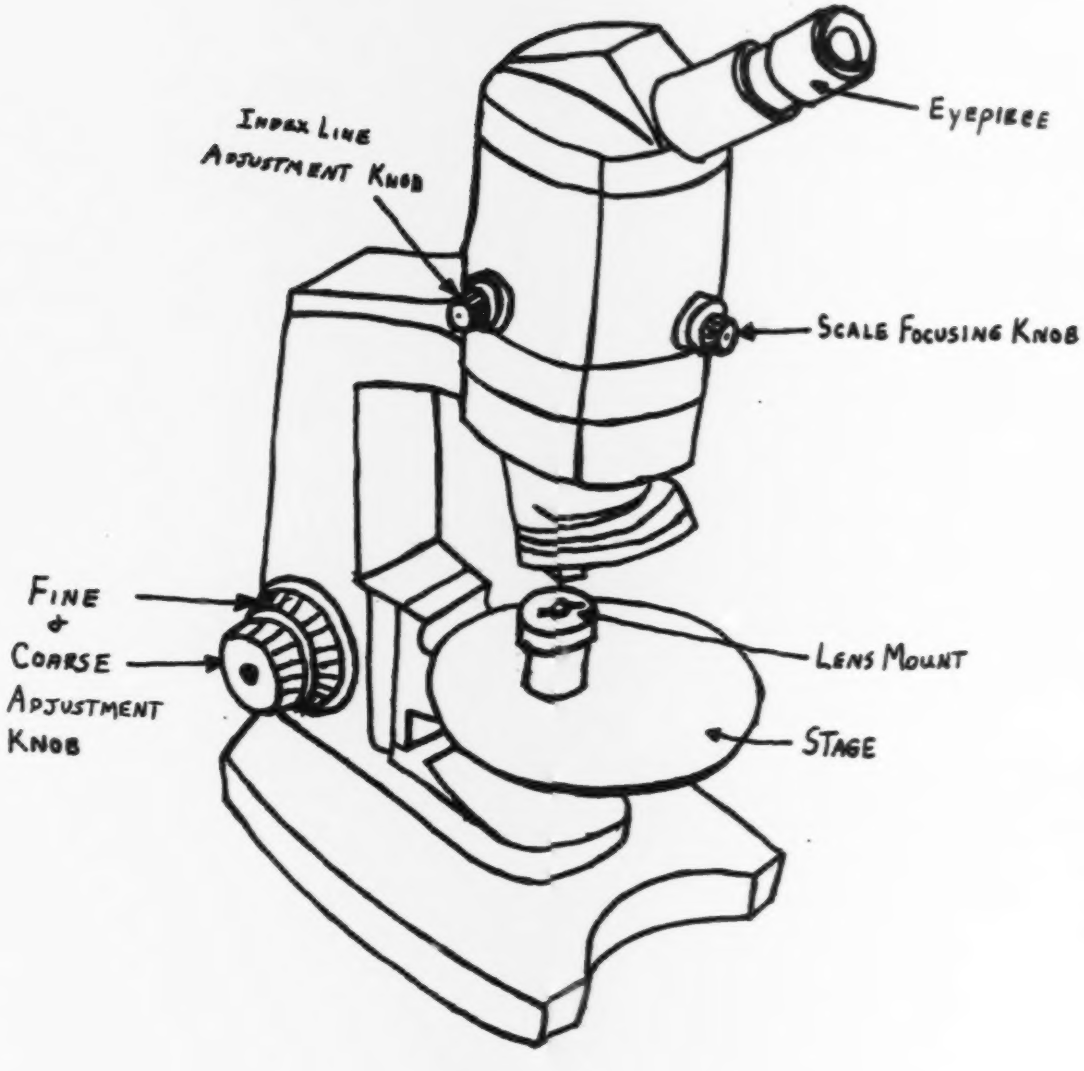
(7) The next move is to turn the index line adjustment knob to "zero" the instrument. Occasionally, you may not be able to "zero" the instrument and you'll have to use the "1", but remember where you started.

(8) Now turn the coarse adjustment away from you until another line star (aerial image) comes into view (fig. 4-17) and adjust with fine focus to make it very sharp and clear. Sometimes you'll need to center image by moving stage. During this second turning of the coarse knob, you'll see a "coil" figure which is the bulb filament. Just pass right on by it because it is of no value to you.

(9) When you have the second star in focus, note the number reading; that is your final reading, the base curve in mm. Suppose you started at "1" and refocused aerial image on 8, then your BC is really 7 mm. It is determined by distance traveled from start to finish.

TABLE 4–1
CONVERSION OF DIOPTERS AS INDICATED ON KERATOMETER TO MILLIMETERS OF RADIUS OF CURVATURE

KERATOMETER READINGS IN DIOPTERS	ACTUAL RADIUS IN MM	
	Convex Surface	Concave Surface
50.00	6.75	6.77
49.87	6.77	6.79
49.75	6.78	6.80
49.62	6.80	6.82
49.50	6.82	6.84
49.37	6.84	6.86
49.25	6.85	6.87
49.12	6.87	6.89
49.00	6.89	6.91
48.87	6.91	6.93
48.75	6.92	6.94
48.62	6.95	6.96
48.50	6.96	6.98
48.37	6.98	7.00
48.25	7.00	7.02
48.12	7.01	7.03
48.00	7.03	7.05
47.87	7.05	7.07
47.75	7.07	7.09
47.62	7.09	7.11
47.50	7.11	7.13
47.37	7.12	7.15
47.25	7.14	7.17
47.12	7.16	7.19
47.00	7.18	7.21
46.87	7.20	7.23
46.75	7.22	7.25
46.62	7.24	7.27
46.50	7.26	7.29
46.37	7.28	7.31
46.25	7.30	7.33
46.12	7.32	7.35
46.00	7.34	7.37
45.87	7.36	7.39
45.75	7.38	7.40
45.62	7.40	7.42
45.50	7.42	7.44
45.37	7.44	7.46
45.25	7.46	7.49
45.12	7.48	7.51
45.00	7.50	7.53
44.87	7.52	7.55
44.75	7.54	7.57
44.62	7.56	7.59
44.50	7.58	7.61
44.37	7.61	7.64
44.25	7.63	7.66
44.12	7.65	7.68
44.00	7.67	7.70
43.87	7.69	7.72
43.75	7.72	7.75
43.62	7.74	7.77
43.50	7.76	7.79
43.37	7.78	7.81
43.25	7.80	7.83
43.12	7.83	7.86
43.00	7.85	7.88
42.87	7.87	7.90
42.75	7.90	7.93
42.62	7.92	7.95
42.50	7.94	7.97
42.37	7.97	8.00
42.25	7.99	8.02
42.12	8.01	8.04
42.00	8.04	8.07
41.87	8.06	8.09
41.75	8.08	8.11
41.62	8.11	8.14
41.50	8.13	8.16
41.37	8.16	8.19
41.25	8.18	8.21
41.12	8.21	8.24
41.00	8.23	8.27
40.87	8.26	8.29
40.75	8.28	8.32
40.62	8.31	8.34
40.50	8.33	8.37
40.37	8.36	8.40
40.25	8.39	8.42
40.12	8.41	8.45
40.00	8.44	8.47
39.87	8.46	8.50
39.75	8.49	8.53
39.62	8.52	8.55
39.50	8.55	8.58
39.37	8.57	8.61
39.25	8.60	8.64
39.12	8.63	8.66
39.00	8.65	8.69
38.87	8.68	8.72
38.75	8.71	8.75
38.62	8.74	8.77
38.50	8.77	8.80
38.87	8.80	8.84
38.25	8.82	8.86
38.12	8.85	8.89
38.00	8.88	8.92
37.87	8.91	8.95
37.75	8.94	8.98
37.62	8.97	9.01
37.50	9.00	9.04
37.37	9.03	9.07
37.25	9.06	9.10
37.12	9.09	9.13
37.00	9.12	9.16
36.87	9.15	9.19
36.75	9.18	9.22
36.62	9.22	9.26
36.50	9.25	9.29
36.37	9.28	9.32
36.25	9.31	9.35
36.12	9.34	9.38
36.00	9.38	9.41
35.87	9.41	9.44
35.75	9.44	9.48
35.62	9.47	9.51
35.50	9.51	9.54
35.37	9.54	9.58
35.25	9.57	9.61
35.12	9.61	9.64
35.00	9.o4	9.68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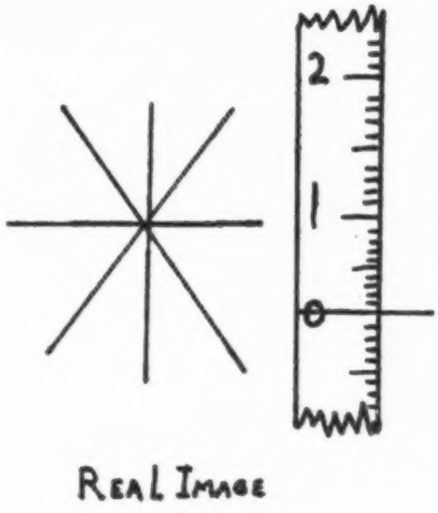
Adjustment Knob
Eyepiece
Scale Focusing Knob
Fine
&
Coarse
Adjustment
Knob
Lens Mount
Stage

Figure 4–15. Radiuscope.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REAL IMAGE

Figure 4–16. Real image.

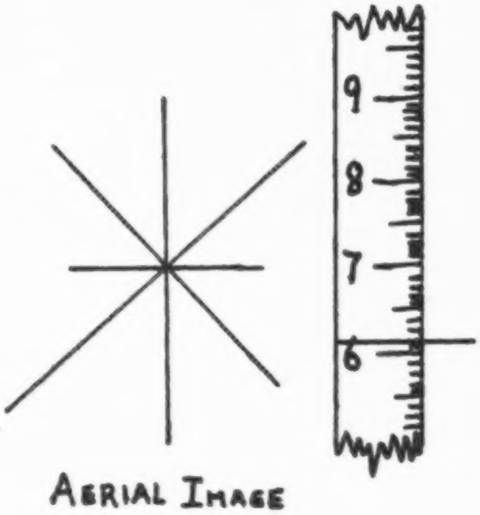
9
8
7
6
AERIAL IMAGE

Figure 4–17. Aerial image.

Exercises (633):

1. What is the purpose of the radiuscope?

2. What is the first consideration when beginning to inspect a lens?

3. What are the first and second line stars called?

4. How is the BC determined?

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NOTE: None of the items listed in the bibliography above are available through ECI. If you cannot borrow them from local sources, such as your base library or local library, you may request one item at a time on a loan basis from the AU Library, Maxwell AFB, AL 36112, ATTN: ECI Bibliographic Assistant. However, the AU Library generally lends only *books* and a limited number of *AFMs*, TOs, classified publications, and other types of publications are *not* available. Refer to current indexes for the latest revisions of and changes to the official publications listed in the bibliography.

ANSWERS FOR EXERCISES

CHAPTER I

Reference:

600 − 1. Second; 3 months.
600 − 2. Fifth; childhood.
600 − 3. First; birth.
600 − 4. Third; 6 months.
600 − 5. Fourth; 1 year.
600 − 6. Sixth; 20 years.
600 − 7. Poor.
600 − 8. Poor.
600 − 9. Good.
600 − 10. Poor.

601 − 1. Intermittent alternating exotropia at farpoint.
601 − 2. Left estropia at nearpoint.
601 − 3. Right hypertropia at farpoint.
601 − 4. Esophoria at farpoint.
601 − 5. Exophoria at nearpoint.
601 − 6. Noncomitant.

602 − 1. Suppression, possible RE(T), excessive hyperopia.
602 − 2. Patient now amblyopic.
602 − 3. Eccentric fixation.
602 − 4. Anomalous retinal correspondence.
602 − 5. 80 percent.
602 − 6. Presbyopia.

603 − 1. Age and motivation.
603 − 2. Because neural patterns are too well established, and there is a possibility of causing other visual disturbances.

604 − 1. Smoothness and ease of eye movements while following the target; patient dizziness or inattentiveness.
604 − 2. Ability to trace the outline exactly.
604 − 3. Amount of prism that produces blur or diplopia; presence or absence of suppression.
604 − 4. Speed and ease of ability to clear the images; amount of accommodation used.
604 − 5. Configuration of string; distance of knot.
604 − 6. BI ductions.
604 − 7. BO ductions—Brock string.
604 − 8. None.
604 − 9. VT to reduce amblyopia; fusion training; BI ductions.
604 − 10. VT to reduce amblyopia; fusion training; BO ductions.
604 − 11. None.
604 − 12. Presbyopes.
604 − 13. Cardholder fixation distance and power of minus lenses used.

605 − 1. Slit occluder, nearpoint card or fine print and distance fixation object.
605 − 2. Because of possible loss of lenses and trial frame.

606 − 1. To establish baseline and detect GLC in its early stages.
606 − 2. Females around age 40.
606 − 3. Aqueous humor is formed in the ciliary body and drains through the Canal of Schlemm.
606 − 4. Overproduction of aqueous and blockage of aqueous drainage.
606 − 5. Narrow-angle.
606 − 6. Open-angle.
606 − 7. Posterior.
606 − 8. As early as conveniently possible.

607 − 1. F. One form of primary glaucoma is the juvenile or congenital type.
607 − 2. F. There are other diseases, such as iritis or conjunctivitis, that may evidence similar signs and symptoms.
607 − 3. T.
607 − 4. F. The glaucomatous patient may see halos around lights because of light diffraction by the edematous cornea.

608 − 1. (1) d.
(2) b.
(3) a.
(4) b, d.
(5) c.
(6) b, c, d.
(7) a.
(8) b.
(9) d.

609 − 1. Ophthalmology.
609 − 2. (a) Two or more measurements of 22mm Hg or higher.
(b) One or more measurements of 25mm Hg or higher.
(c) A difference of more than 4mm Hg between eye.
609 − 3. 7 mm; water provocative.
609 − 4. 7 to 10 mm; dark-room.

610 − 1.
(1) Retinal receptors—convert light to neural impulse.
(2) Optic nerve—transmits nerve fibers from retina.
(3) Optic chiasm—partial crossing of nerve fibers.
(4) Optic tract—transmits rearranged nerve fibers.
(5) Lateral geniculе body—important synapse area.
(6) Optic radiations—transmit visual fibers.
(7) Visual cortex—located in occipital lobes.

611 − 1. Scotomas—isolated areas of blindness.
Depressions—most common defect areas of reduced vision.
Contractions—rare—blind areas with steep margins.
611 − 2. Negative.
611 − 3. Behind the retina.
611 − 4. On the retina.

612 − 1. (1) d.
(2) b.
(3) z.
(4) c.
(5) f.
(6) e.
(7) g.

613 − 1. d, e, g. h.
613 − 2. a, g.
613 − 3. a, b, f.
613 − 4. c, d.
613 − 5. j.
613 − 6. k.
613 − 7. a, b, f.
613 − 8. d.
613 − 9. b, c, d, h.
613 − 10. j.
613 − 11. c.

614 − 1. Central; blind spot.
614 − 2. Central and peripheral; blind spot and peripheral vision.
614 − 3. Central; blind spot and fixation.
614 − 4. Peripheral; all temporal quadrants.
614 − 5. Peripheral; all nasal quadrants.
614 − 6. Peripheral; all quadrants.
614 − 7. Central and peripheral; general shape.

CHAPTER 2

615 – 1. 20/40 or better.
615 – 2. 20/70 in poorer eye and 20/30 in the better eye.

616 – 1. S–10.
616 – 2. Work in an eye hazardous area.
616 – 3. (1) The person has no Rx but is complaining;
  (2) the person has an Rx and is complaining;
  (3) the person has broken the Rx presently used.
616 – 4. DD Form 771.

617 – 1. Equality and reaction.
617 – 2. None.
617 – 3. Flying training.
617 – 4. (a) No, this is not a flying PE.
  (b) Yes.
  (c) No, but a note should be made in item 73.
  (d) No, enter the power of his glasses.
617 – 5. 14/17.
617 – 6. (1) If a PIP test is not available; (2) if patient failed VTS–CV; and (3) if color deficiency was not previously detected.
617 – 7. Confrontation test.
617 – 8. Probable malingering.
617 – 9. (a) Enter "CL yes" in item 60.
  (b) Notify your OD and the flight surgeon.

618 – 1. E–1.
618 – 2. E–1.
618 – 3. E–1.
618 – 4. E–2.
618 – 5. E–2.
618 – 6. E–2.
618 – 7. E–2.
618 – 8. E–3.
618 – 9. E–3.
618 – 10. E–3.
618 – 11. E–4.

CHAPTER 3

619 – 1. Alkali.
619 – 2. Irrigated with water.
619 – 3. Irrigated with water.
619 – 4. Olive oil.
619 – 5. 0.4-percent sodium sulphite in glycerine or glycerine alone.
619 – 6. 2 percent sodium fluorescein solution.

620 – 1. (1) b, d.
  (2) a, c.
  (3) e.
620 – 2. (1) b.
  (2) a.
  (3) c.
620 – 3. (1) c.
  (2) a.
  (3) b.

621 – 1. A pressure dressing.
621 – 2. The globe is lacerated.
621 – 3. Corneal abrasions.
621 – 4. Lying face up.
621 – 5. Should not.
621 – 6. Irrigation.

622 – 1. (1) b.
  (2) a.
  (3) b.
622 – 2. Central retinal artery occlusion, central retinal vein occlusion, and retinal detachment.
622 – 3. Medicolegal purposes. The patient may claim a loss of vision due to your treatment (and not to the injury).

623 – 1. Conjunctivitis; corneal trauma; keratitis; iritis; angle closure; glaucoma; cataracts.
623 – 2. 10–15X.
623 – 3. Diffused illumination with slit at maximum width.

624 – 1. A good case history.
624 – 2. Anything from swelling and redness around the site of application to convulsion and death.
624 – 3. (1) Stop instilling the drug.
  (2) Place the patient in a reclining position.
  (3) Call a physician for help.
624 – 4. One.
624 – 5. In the lower conjunctival sac.
624 – 6. Mydrias.
624 – 7. Miosis.
624 – 8. Mydriatics.
624 – 9. Cycloplegics.
624 – 10. Tropicamide; cyclopentolate (cyclogel).
624 – 11. Proparacaine.

CHAPTER 4

625 – 1. (1) b.
  (2) a.
  (3) c.
  (4) c.
625 – 2. Essential.
625 – 3. Cosmetic.
625 – 4. Cosmetic, but could be essential due to AFSC.
625 – 5. Cosmetic.
625 – 6. Essential.

626 – 1. (a) Peripheral curve width.
  (b) Intermediate curve width.
  (c) Diameter.
  (d) Optical zone diameter.
  (e) Fenestration.
  (f) Peripheral curve radius.
  (g) Intermediate curve radius.
  (h) Base curve.
  (i) Thickness.

627 – 1. (1) c.
  (2) a, b.
  (3) b.
  (4) b, h.
  (5) d.
  (6) e, f.
  (7) g, h.
627n 2. (1) b, e.
  (2) c.
  (3) d.
  (4) c.
  (5) f.
  (6) e.
  (7) g.
  (8) a.

628 – 1. Polymethylmethacrylate (PMMA).
628 – 2. Design characteristics, such as flexibility and thinness.
628 – 3. Cost less; durable; easy to care for and handle; optics are better.
628 – 4. Break-in period; breakage; become flattened; spectacle blur.

629 – 1. Hygiene by washing his or her hands.
629 – 2. To remove any build-up of cosmetics or oily secretions.
629 – 3. Convex side.
629 – 4. Eyelid.
629 – 5. Two; one-finger method and two-finger method.

630 – 1. Instant feedback; improving patient rapport; increasing personnel's abilities and knowledge.
630 – 2. Reducing diameter; enlarging bevel; changing edge configuration; blending junction of curves; changing power.

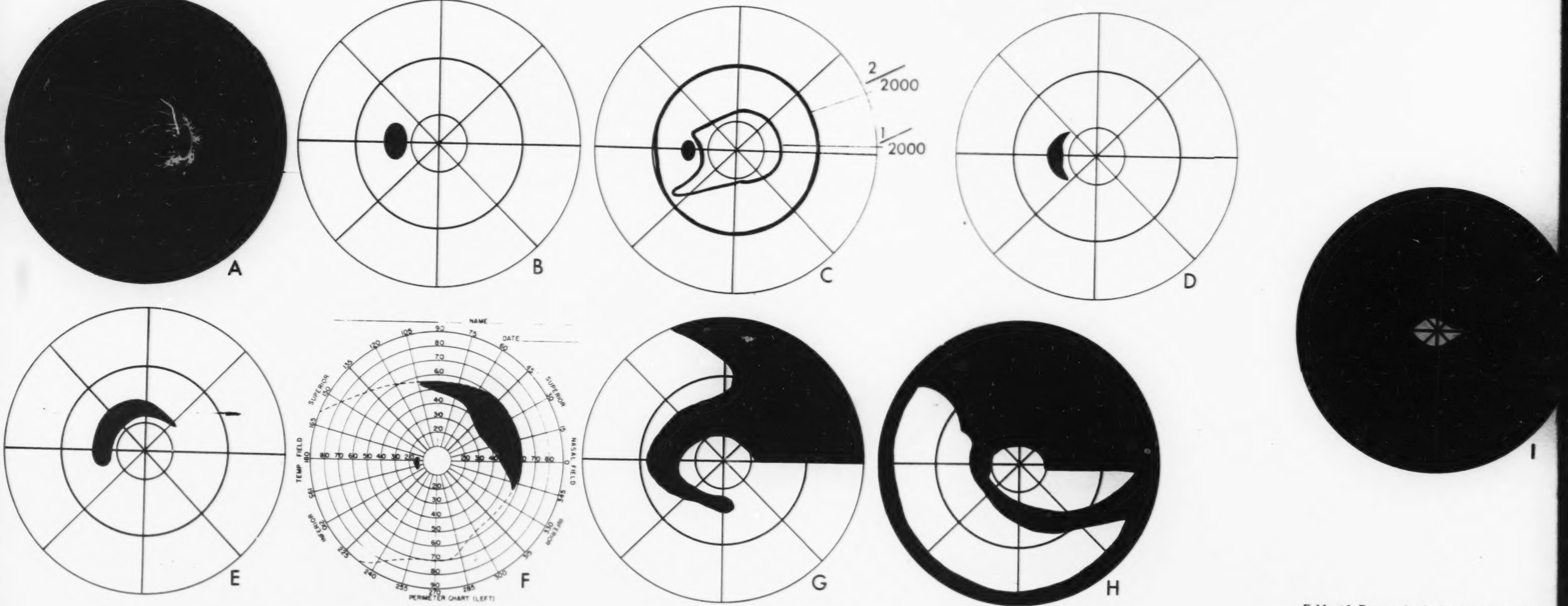
631 – 1. F. Any conventional CL solution may not be used to soak and clean these lenses.
631 – 2. F. The soft lens must be removed before swimming. Many hard lens wearers leave their lenses in.

631 – 3. T.
631 – 4. T.

632 – 1. Image-doubling system.
632 – 2. The white movable occluder.
632 – 3. Lower right.
632 – 4. Plus signs; left.
632 – 5. Lower right.
632 – 6. Minus signs; right.
632 – 7. Instrument barrel.

633 – 1. To inspect and verify BC, fenestrations, and general optics.
633 – 2. Clean the lens.
633 – 3. Real image and aerial image.
633 – 4. Note the beginning reading and the second reading; the distance traveled is the BC.

1984-746-037/2084 AUGAFS,AL(842246)300



A
B
2/2000
1/2000
C
D
E
NAME
DATE
SUPERIOR
TEMP FIELD
NASAL FIELD
INFERIOR
PERIMETER CHART (LEFT)
F
G
H
I

Foldout 1. Progression in the visual field of glauc

STOP - 1. **MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.**
2. **USE NUMBER 2 PENCIL ONLY.**

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

91255 04 23
ADVANCED OPTOMETRY CLINIC PROCEDURES

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet .
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover your answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you have to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If mandatorily enrolled student, process questions or comments through your unit trainer or OJT supervisor. If voluntarily enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the Learning Objective Number where the answer to that item can be located. When answering the items on the VRE, refer to the Learning Objectives indicated by these Numbers. The VRE results will be sent to you on a postcard which will list the actual VRE items you missed. Go to the VRE booklet and locate the Learning Objective Numbers for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the best answer to each question.

1. (600) Most refractive errors stabilize at about what age?

   a. 5 years.
   b. 10 years.
   c. 20 years.
   d. 40 years.

2. (601) A heterotropia is a condition in which

   a. both eyes deviate in or out.
   b. both eyes deviate up or down.
   c. one eye fixates and the other deviates up, down, in, or out.
   d. one eye is occluded.

3. (602) A patient who demonstrates a short attention span, poor reading ability, and a cluster of other learning problems most likely has

   a. an amblyopia problem.
   b. a focusing problem.
   c. a perceptual problem.
   d. an eccentric fixation problem.

4. (603) When the visual problem is heterotropia which of the following will usually respond best to VT?

   a. Children with ET.
   b. Children with XT.
   c. Adults with HT.
   d. Adults with XT.

5. (604) The ability to place and maintain a retinal image of an object on the fovea and recenter it whenever it departs is the function or objective of which VT exercise?

   a. Brock string.
   b. Duction.
   c. Copying exercise.
   d. Pursuit movement.

6. (604) Which of the following is not recommended as a method to follow in the treatment of esophoria?

   a. Use of base-out prisms.
   b. Occasional use of miotic drugs.
   c. Maximum negative lenses for reading.
   d. Divergence exercises with base-in prisms.

7. (604) What works best on patients with accommodative ET?

   a. Maximum minus lenses.
   b. Base-in prism.
   c. Plus lenses and/or bifocals.
   d. Slab-off prisms.

8. (605) How do minus lenses aid a patient with accommodative problems?

a. Stimulates focusing.
b. Make images harder to see.
c. Make images brighter.
d. Causes pupils to constrict.

9. (606) Which of the following glaucomas is more prevalent in presbyopes?

a. Closed angle.
b. Open angle.
c. Secondary.
d. Juvenile.

10. (606) Aqueous humor passes from the posterior to the anterior chamber through the

a. corneoscleral junction.
b. Canal of Schlemm.
c. retinal veins.
d. pupil.

11. (607) Which of the following groups of signs and symptoms most likely represents glaucoma?

a. Constant pain, constricted pupil, and normal vision.
b. Eye pain late at night, immobile pupils, and poor night vision.
c. Eye pain after work, dilated pupils, and normal night vision.
d. Eye pain in the morning, loss of peripheral fields, and poor night vision.

12. (607) Visual acuity in a glaucomatous patient may be reduced because of

a. constricted pupils.
b. corneal abrasions.
c. corneal edema.
d. Hemianopsia.

13. (608) The loading weights of the Schiotz are part of the

a. plunger assembly.
b. frame assembly.
c. footplate assembly.
d. indicator assembly.

14. (608) The cold (wet) sterilization of Schiotz tonometers requires the use of a solution of

a. 1/5000 Zephiran.
b. 1/100 benzalkonium chloride.
c. 1/5 alcohol.
d. 1/4 ether.

15. (608) What scale reading would indicate the necessity for repeating the Schiotz tonometry with a heavier weight?

a. 7.5 or less.
b. 6.5 or less.
c. 5.5 or less.
d. 4 or less.

16. (608) Which tonometer gives a digital readout after tonometry is accomplished?

a. Tactical.
b. Applanation.
c. Non-contact.
d. Schiotz.

17. (609) Which of the following may not be a reason for a glaucoma workup?

a. Two or more measurements of 22 mm Hg or higher.
b. One or more measurements of 25 mm Hg or higher.
c. A difference of more than 4 mm Hg between eyes.
d. A scale reading of 4 or more.

18. (609) A patient with closed-angle glaucoma will fail the darkroom provocative test because

a. the dark room reflex causes elevated blood pressure.
b. more aqueous is produced in a darkened environment.
c. the dilated pupils may restrict the Canal of Schlemm.
d. the dilated pupils allow more aqueous to enter the anterior chamber.

19. (610) The correct way to list the visual pathway from anterior to posterior is

a. retina, nerve, chiasm, tract, LBG, radiation and brain.
b. retina, tract, chiasm, tract, radiation, LBG and brain.
c. retina, nerve, chiasm, radiation, LBG and brain.
d. retina, nerve, tract, chiasm, radiation, LBG and brain.

20. (611) Which of the following is most descriptive of a visual field contraction?

a. Rare, central, sharp borders.
b. Rare, peripheral, sharp borders.
c. Common, peripheral, sloping borders.
d. Common, central, sloping borders.

21. (612) The optic nerve head is located in the

a. temporal retina.
b. temporal field.
c. nasal retina.
d. nasal fields.

22. (613) Which of the following yields more diagnostic results in peripheral field measurements?

a. Autoplot tests.
b. Arc perimeter tests.
c. Campimeter tests.
d. Confrontation field tests.

23. (613) For a confrontation fields exam, the target used is of what color and size?

a. 1-cm white.
b. 2-cm white.
c. 3-cm blue.
d. 10-cm blue.

24. (613) A Brombach perimeter resembles an arc with a radius of

a. 10-dm.
b. 13-cm.
c. 24-cm.
d. 33-cm.

25. (613) The Amsler grid provides a method for detecting

a. abnormalities in the heart of the central field.
b. naisometropia.
c. visual hysteria.
d. negative scotomata.

26. (613) What are the test distances for the tangent screen?

a. 1 or 2 ft.
b. 1 or 2 m.
c. 18 or 36 in.
d. 100 or 1000 cm.

27. (614) An early field defect in glaucoma is called

a. an "extension of the blind spot."
b. an "enlargement of the blind spot."
c. a "reduction of the blind spot."
d. a "baring of the blind spot."

28. (614) In a well-established glaucoma, central vision may remain 20/20 until the field loss is within how many degrees of fixation?

a. 1°.
b. 2°.
c. 3°.
d. 4°.

29. (614) Postchiasmal lesions usually produce a visual field defect which affects both

a. fields equally.
b. fields nonsymmetrically.
c. nasal and temporal fields.
d. right and left half-fields.

30. (614) If, while doing a visual exam, you suspect the patient of malingering, what should you do?

a. Confront the patient tactfully with your suspicions.
b. First attempt to trick the patient to confirm your suspicions.
c. Tell your doctor of your suspicions and do not waste any more time on the patient.
d. Never suspect your patients of malingering, since they are not well to begin with.

31. (615) The binocular horizontal field required by the USAF for a Government driver's license is

a. 100°.
b. 120°.
c. 140°.
d. 180°.

32. (615) Wearing tinted lenses while driving at night

a. reduces the energy striking the retina.
b. improves vision by reducing glare.
c. reduces the effect of night blindness.
d. quickens the reaction time because of improved vision.

33. (616) One of the tasks an optometry technician in caring for patients who work in eye hazardous areas is

a. doing the complete examinations.
b. to screen and refer or initiate the spectacle order.
c. ordering spectacles from the military labs.
d. to fill out the DD Form 1348-6s for the patients.

34. (617) When checking pupils of a patient you find that the pupils react to light and accomodation, but that the pupils are not equally round. How would you record this finding on the SF 88, Report of Medical Examination?

a. PRLA.
b. ERRLA.
c. PRRLA.
d. PERLA.

35. (617) What is the name of the refraction performed on all flying trainees by the optometrist?

a. Manifest.
b. Refraction (dry).
c. Cycloplegic.
d. Keratometry.

36. (617) The test distances for the Red lens test is

a. 18 inches.
b. 20 inches.
c. 36 inches.
d. 1 meter.

37. (618) A profile serial that contains one or more 4s but is not considered permanent will be designated by what initial?

a. "L".
b. "P".
c. "T".
d. "W".

38. (619) Ocular emergencies due to acid or alkali should be treated

a. the same, irrigate with olive oil.
b. different, because they burn differently.
c. the same, irrigate with water.
d. only when an ophthalmologist arrives.

39. (620) The most common eye injury incurred while watching electric welding operations without appropriate goggles is damage due to

a. heat radiation.
b. infrared radiation.
c. electric radiation.
d. ultraviolet radiation.

40. (620) The most common eye injury incurred while watching a solar eclipse without proper protection is damage due to

a. heat radiation.
b. infrared radiation.
c. solar energy.
d. ultraviolet radiation.

41. (621) When the eyelids are lacerated and the eyeball is not involved, how may the bleeding be controlled?

a. Apply a pressure dressing.
b. Apply a loose bandage.
c. Keep patient on the back, use no bandage.
d. Apply ice to cause fast clotting.

42. (621) When the patient has an apparent superficial foreign body on the cornea, you first should attempt to remove it

a. with a cotton swab.
b. by water irrigation.
c. by blowing at patient's eye.
d. by slapping the patient on the back.

43. (622) A patient has entered the clinic complaining of severe eye irritation. What should you do, when possible, before initiating treatment?

a. Determine presence of allergies.
b. Take visual acuities.
c. Instill an analgesic.
d. Measure IOP.

44. (623) The slit lamp can be used for the diagnosis of all the following except for

a. corneal trauma.
b. conjunctivitis.
c. iritis.
d. lesions in the optic tract.

45. (623) When using the slit lamp on a patient, you should first begin by setting the magnification at 10-15x and the angle at

a. 45°.
b. 70°.
c. 85°.
d. 90°.

46. (624) What is the best way to prevent drug reactions?

a. Check the label for the word "ophthalmic."
b. Read the label 3 times.
c. Take a good case history.
d. Follow doctor's directions.

47. (624) The use of pilocarpine causes

a. mydriasis (pupillary constriction).
b. mydriasis (pupillary dilation).
c. miosis and stimulates accomodation.
d. pupillary dilation and accomodation spasms.

48. (624) A reaction to a drug which normally would be harmless is called

a. an adrenergic reaction.
b. an oculargic reaction.
c. a lethargic reaction.
d. a hypergic reaction.

49. (625) Patients who are considered to need contact lenses for visually essential reasons will pay

a. nothing for materials or services.
b. for the cost of materials only.
c. a nonappropriated fund account for services.
d. an appropriated fund account for materials and services.

50. (625) If your clinic has set up a contact lens program, where should patients when required buy contact lenses if the BX optical shop carries such contacts?

a. At the BX optical shop.
b. Through base supply.
c. At any optical shop they choose.
d. Through a mail order optical business.

51. (626) Which of the following variables represents the total width of a contact lens?

a. OZ radius.
b. IC width.
c. PC width.
d. Diameter.

52. (626) A contact lens modification which makes the finished lens look like a "D" on its side is

a. a truncation.
b. A fenestration.
c. A prism ballast.
d. An edge treatment.

53. (626) A contact lens modification which allows better oxygenation and tear flow is

a. truncation.
b. a beveled edges.
c. a flared edges.
d. a fenestration.

54. (627) One of the most important variables to be verified is the

a. PC width.
b. base curve.
c. thickness.
d. OZ diameter.

55. (627) A lensometer is used to verify the contact lens'

a. base curve.
b. diameter.
c. intermediate curve.
d. power.

56. (628) Of what are todays hard contact lenses usually made?

a. HEMA.
b. PMMA.
c. A glass with a plastic insert.
d. Glass.

57. (628) Which of the following is not an advantage of hard contact lens?

a. Cost.
b. Ease of cleaning.
c. They are unbreakable.
d. Optics are very good.

58. (629) Hard contact lens soaking solutions have what special agent in them?

a. A refined soap.
b. An antibacterial solution.
c. Special oils.
d. Normal saline.

59. (630) Doing modification on contact lenses in your clinic will provide all except

a. a positive fitting feedback.
b. an improved rapport between the doctor and patient.
c. an increase in the technicians education about contacts.
d. extra cash for your clinic.

60. (631) Most soft contact lenses are made of

a. HEMA and water.
b. HEMA and rubber.
c. PMMA and water.
d. PMMA and rubber.

61. (631) When ordering soft lenses, they are usually specified by

a. thickness, PAR, and power.
b. power, PAR, and diameter.
c. diameter, PAR, and thickness.
d. diameter, power, and thickness.

62. (632) A preliminary keratometer eye adjustment is done by focusing on the

a. target cross.
b. target circle.
c. plus sign.
d. minus sign.

63. (632) "Oblique" astigmatism means the

a. cornea is more steeply curved in the 90° meridian.
b. cornea is more steeply curved in the 180° meridian.
c. meridian of most corneal power is between 0° and 30° or between 150° and 180°.
d. meridian of most corneal power is between 30° and 60° or between 120° and 150°.

64. (633) The radiuscope is used to check all the following except for

a. the exact power.
b. general optics.
c. the base curve.
d. fenestrations.

65. (633) What is the resultant image for calculating the base curve when using the radioscope?

a. The real image.
b. The aerial image.
c. An inverted image.
d. A reverted image.

END OF EXERCISE

ATC/ECI SURVEY

The remaining questions (125-135) are not part of the Volume Review Exercise (VRE). These questions are a voluntary ATC/ECI survey. Using a number 2 pencil, indicate what you consider to be the appropriate response to each survey question on your answer sheet (ECI Form 35), beginning with answer number 125. Do not respond to questions that do not apply to you. Your cooperation in completing this survey is greatly appreciated by ATC and ECI. (AUSCN 100)

PRIVACY ACT STATEMENT

A. Authority: 5 U.S.C. 301, Departmental Regulations

B. Principal Purpose: To gather preliminary data evaluating the ATC/ECI Career Development Course (CDC) Program.

C. Routine Uses: Determine the requirement for comprehensive evaluations in support of CDC program improvement.

D. Whether Disclosure is Mandatory or Voluntary: Participation in this survey is entirely voluntary.

E. Effect on the Individual of not Providing Information: No adverse action will be taken against any individual who elects not to participate in any or all parts of this survey.

QUESTIONS:

125. If you have contacted ECI for any reason during your enrollment, how would you describe the service provided to you?

a. Excellent.
b. Satisfactory.
c. Unsatisfactory.
d. Did not contact ECI.

126. My ECI course materials were received within a reasonable period of time.

a. Strongly agree.
b. Agree.
c. Disagree.
d. Strongly disagree.

127. The condition of the course materials I received from ECI was:

a. A complete set of well-packaged materials.
b. An incomplete set of well-packaged materials.
c. A complete set of poorly packaged materials.
d. An incomplete set of poorly packaged materials.

128. The reading level of the material in the course was too difficult for me.

a. Strongly agree.
b. Agree.
c. Disagree.
d. Strongly disagree.

129. The technical material in the course was too difficult for me at my present level of training.

a. Strongly agree.
b. Agree.
c. Disagree.
d. Strongly disagree.

130. The illustrations in the course helped clarify the information for me.

a. Strongly agree.
b. Agree.
c. Disagree.
d. Strongly disagree.

131. Approximately how much information in the course provides general information about your AFSC?

a. Between 80 and 99%.
b. Between 60 and 79%.
c. Between 40 and 59%.
d. Between 20 and 39%.

132. Approximately how much information in this course was current?

a. Between 80 and 99%.
b. Between 60 and 79%.
c. Between 40 and 59%.
d. Between 20 and 39%.

133. The format of the text (objective followed by narrative and exercises) helped me study.

a. Strongly agree.
b. Agree.
c. Disagree.
d. Strongly disagree.

134. The volume review exercise(s) helped me review information in the course.

a. Strongly agree.
b. Agree.
c. Disagree.
d. Strongly disagree.

135. Check the rating which most nearly describes the usefulness of the information in this CDC in your upgrade training program.

a. Excellent.
b. Satisfactory.
c. Marginal.
d. Unsatisfactory.

NOTE: If you know this CDC contains outdated information or does not provide the knowledge that the current specialty training standard requires you to have for upgrade training, contact your OJT advisor and fill out an AF Form 1284, Training Quality Report.

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 44 USC 3101. PRINCIPAL PURPOSE(S): To provide student assistance as requested by individual students. ROUTINE USES: This form is shipped with every ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. DISCLOSURE: Voluntary. The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance.

SECTION I: CORRECTED OR LATEST ENROLLMENT DATA: MAIL TO: ECI, GUNTER AFS, ALA 36118

1. THIS REQUEST CONCERNS COURSE
2. TODAY'S DATE
3. ENROLLMENT DATE
4. PREVIOUS SERIAL NUMBER
5. SOCIAL SECURITY NUMBER ☐☐☐ – ☐☐ – ☐☐☐☐
6. GRADE/RANK
7. INITIALS ☐☐ LAST NAME
8. OTHER ECI COURSES NOW ENROLLED IN
9. ADDRESS: (OJT ENROLLEES - ADDRESS OF UNIT TRAINING OFFICE/ALL OTHERS - CURRENT MAILING ADDRESS)

ZIP CODE ☐☐☐☐☐

10. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE:
11. AUTOVON NUMBER
12. TEST CONTROL OFFICE ZIP CODE/SHRED

SECTION II: Old or INCORRECT ENROLLMENT DATA

1. NAME: 2. GRADE/RANK: 3. SSAN:
4. ADDRESS: 5. TEST OFFICE ZIP/SHRED:

SECTION III: REQUEST FOR MATERIALS, RECORDS, OR SERVICE

(Place an "X" through number in box to left of service requested)

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. The latest course workbooks have a Form 17 printed on the last page.

1 EXTEND COURSE COMPLETION DATE. (Justify in Remarks)
2 SEND VRE ANSWER SHEETS FOR VOL(s): 1 2 3 4 5 6 7 8 9 - ORIGINALS WERE: NOT RECEIVED, LOST, MISUSED
3 SEND COURSE MATERIALS (Specify in remarks) - ORIGINALS WERE: NOT RECEIVED, LOST, DAMAGED.
4 COURSE EXAM NOT YET RECEIVED. FINAL VRE SUBMITTED FOR GRADING ON (Date):
5 RESULTS FOR VRE VOL(s): 1 2 3 4 5 6 7 8 9 NOT YET RECEIVED. ANSWER SHEET(s) SUBMITTED ON (Date):
6 RESULTS FOR CE NOT YET RECEIVED. ANSWER SHEET SUBMITTED TO ECI ON (Date):
7 PREVIOUS INQUIRY (ECI FORM 17, LTR, MSG) SENT TO ECI ON:
8 GIVE INSTRUCTIONAL ASSISTANCE AS REQUESTED ON REVERSE:
9 OTHER (Explain fully in remarks)

REMARKS: (Continue on Reverse)

OJT STUDENTS must have their OJT Administrator certify this request.	I certify that the information on this form is accurate and that this request cannot be answered at this station. (Signature)
ALL OTHER STUDENTS may certify their own requests.	

ECI FORM 17 JUN 77 PREVIOUS EDITIONS MAY BE USED

SECTION IV: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of textual material should be forwarded directly to preparing agency. Name of agency can be found at the bottom of the inside cover of each text. All other inquiries concerning the course should be forwarded to ECI.

VRE ITEM QUESTIONED: MY QUESTION IS:

Course No. ____________

Volume No. ____________

VRE Form No. __________

VRE Item No. __________

Answer You Chose
(Letter) ___________

Has VRE Answer Sheet
been submitted for grading?

☐ YES ☐ NO

REFERENCE
(Textual support for the
answer I chose can be
found as shown below)

In Volume No: _________

On Page No: ___________

In_____ (Left)_____(Right)
Column

Lines_____Through______

Remarks:

91255 00 S01 8309

CHANGE SUPPLEMENT

CDC 91255

OPTOMETRY SPECIALIST

(AFSC 91255)

IMPORTANT: Make the corrections indicated in this supplement before beginning study of Volumes 1 and 3. This supplement contains both "pen-and-ink" changes and replacement pages. It is perforated and three-hole-punched so that you can tear out the replacement pages and insert them in your volume. You are not required to post any changes listed in this supplement which correct typographical errors, unless such errors change or otherwise affect the meaning of the material.

Extension Course Institute

Air University

CHANGES FOR THE TEXT: VOLUME 1

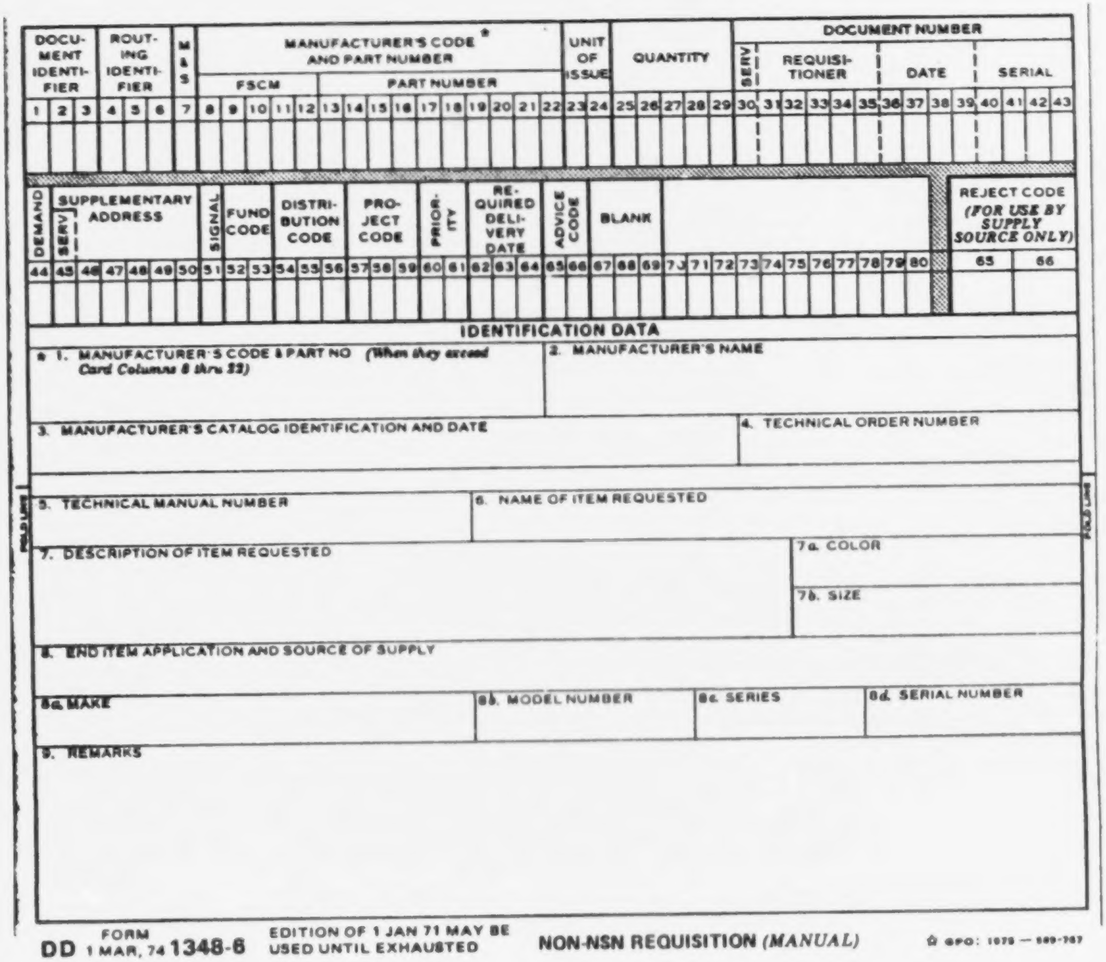
Pen-and-Ink Changes:

Page-Col	*Subject*	*Line(s)*	*Correction*
Cover		5	Change "2" to "1."
46L		11–12	Delete "*a*. An action code . . . in table 6-2."
46R	Table 6-1		Change symbol "K" to "Q."
47L	Table 6-2		Delete.
48L		8 fr bot	Change "601b, Custodian Request/Receipt" to "601, Equipment Action Request."
53	Bibliography		Add "AFM 67-1, *USAF Supply Manual*, Volume 5, Chapter 18."

Page Changes:

Remove Pages	*Insert Pages*
49–52	49–52

347



DOCUMENT IDENTIFIER	ROUTING IDENTIFIER	M & S	MANUFACTURER'S CODE * AND PART NUMBER		UNIT OF ISSUE	QUANTITY	DOCUMENT NUMBER			
			FSCM	PART NUMBER			SERV	REQUISITIONER	DATE	SERIAL
1 2 3	4 5 6	7	8 9 10 11 12	13 14 15 16 17 18 19 20 21 22	23 24	25 26 27 28 29	30	31 32 33 34 35	36 37 38 39	40 41 42 43

DEMAND	SUPPLEMENTARY ADDRESS		SIGNAL	FUND CODE	DISTRIBUTION CODE	PROJECT CODE	PRIORITY	REQUIRED DELIVERY DATE	ADVICE CODE	BLANK		REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY)	
	SERV												
44	45	46 47 48 49 50	51	52 53	54 55 56	57 58 59	60 61	62 63 64	65 66	67 68 69	70 71 72 73 74 75 76 77 78 79 80	65	66

IDENTIFICATION DATA

* 1. MANUFACTURER'S CODE & PART NO (*When they exceed Card Columns 8 thru 22*)

2. MANUFACTURER'S NAME

3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE

4. TECHNICAL ORDER NUMBER

5. TECHNICAL MANUAL NUMBER

6. NAME OF ITEM REQUESTED

7. DESCRIPTION OF ITEM REQUESTED

7a. COLOR

7b. SIZE

8. END ITEM APPLICATION AND SOURCE OF SUPPLY

8a. MAKE

8b. MODEL NUMBER

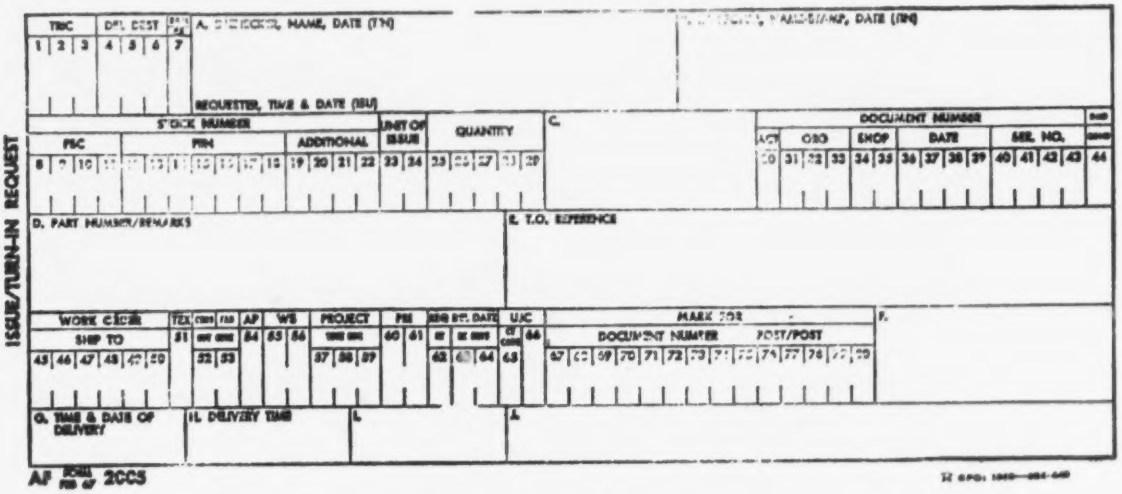
8c. SERIES

8d. SERIAL NUMBER

9. REMARKS

DD FORM 1 MAR, 74 1348-6 EDITION OF 1 JAN 71 MAY BE USED UNTIL EXHAUSTED NON-NSN REQUISITION (*MANUAL*) ☆ GPO: 1975 — 589-767

Figure 6–6. Sample DD Form 1348–6.



ISSUE/TURN-IN REQUEST

TRIC	[illegible]	[illegible]	A. [illegible], NAME, DATE (TN)	[illegible], NAME-STAMP, DATE (ISN)
1 2 3	4 5 6	7	REQUESTER, TIME & DATE (ISU)	

STOCK NUMBER			UNIT OF ISSUE	QUANTITY	C.	DOCUMENT NUMBER					[illegible]
FSC	FIIN	ADDITIONAL				ACT	ORG	SHOP	DATE	SER. NO.	
8 9 10 11	12 13 14 15 16 17 18	19 20 21 22	23 24	25 26 27 28 29		30	31 32 33	34 35	36 37 38 39	40 41 42 43	44

D. PART NUMBER/REMARKS

E. T.O. REFERENCE

WORK CENTER	TEX	[illegible]	AP	WS	PROJECT	PRI	REQ DEL DATE	UJC		MARK FOR	F.
SHIP TO										DOCUMENT NUMBER POST/POST	
45 46 47 48 49 50	51	52 53	54	55 56	57 58 59	60 61	62 63 64	65	66	67 68 69 70 71 72 73 74 75 76 77 78 79 80	

G. TIME & DATE OF DELIVERY

H. DELIVERY TIME

I.

J.

AF FORM FEB 67 2005 ☆ GPO: [illegible]

Figure 6–7. Sample AF Form 2005.

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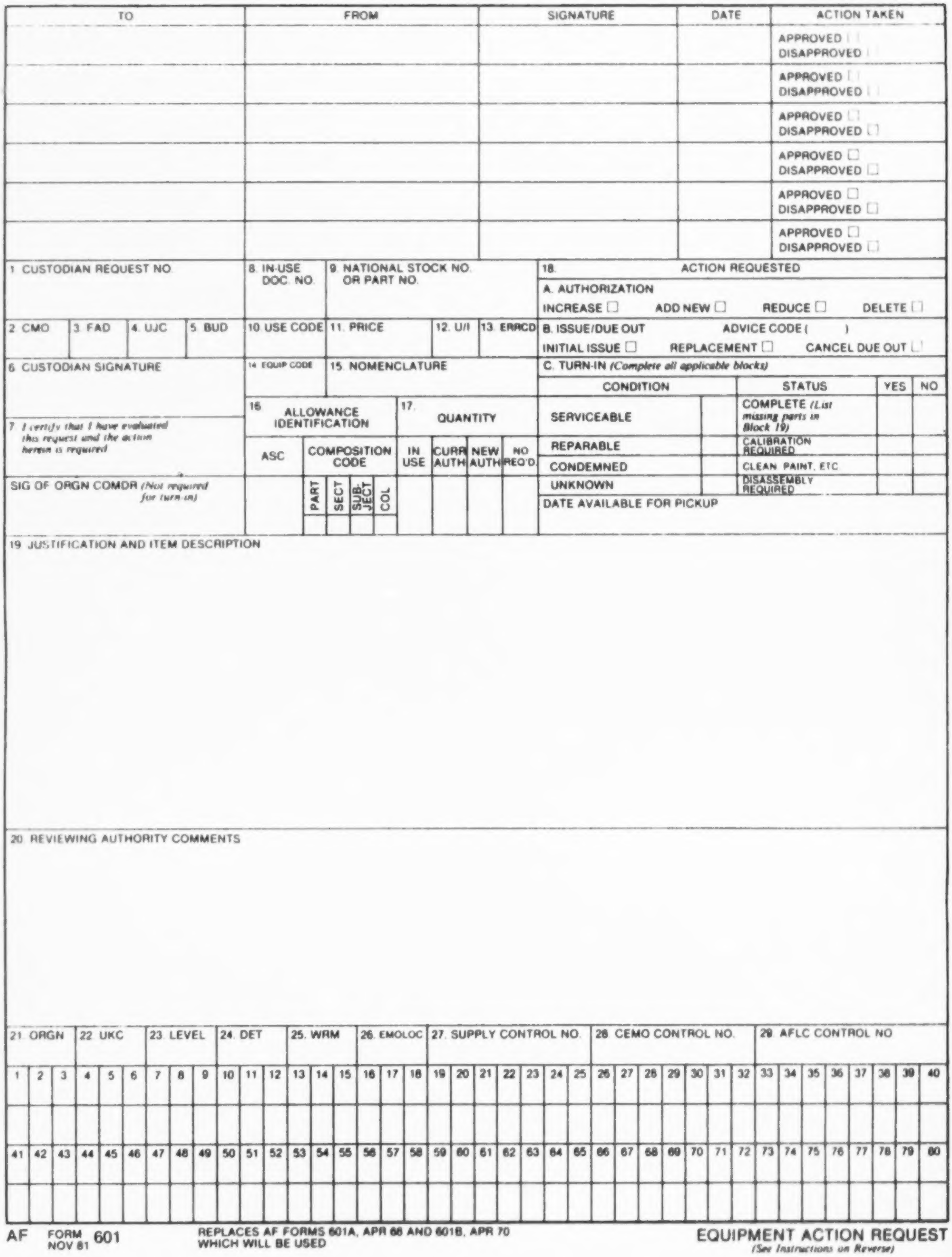

TO	FROM	SIGNATURE	DATE	ACTION TAKEN
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐

1 CUSTODIAN REQUEST NO.

8. IN-USE DOC. NO.

9. NATIONAL STOCK NO. OR PART NO.

2 CMO | 3 FAD | 4 UJC | 5 BUD

10 USE CODE | 11. PRICE | 12. U/I | 13. ERRCD

6 CUSTODIAN SIGNATURE

14 EQUIP CODE

15 NOMENCLATURE

7 *I certify that I have evaluated this request and the action herein is required*

SIG OF ORGN COMDR *(Not required for turn-in)*

16 ALLOWANCE IDENTIFICATION					17. QUANTITY			
ASC	COMPOSITION CODE				IN USE	CURR AUTH	NEW AUTH	NO REQ'D.
	PART	SECT	SUB-JECT	COL				

18. ACTION REQUESTED

A. AUTHORIZATION

INCREASE ☐ ADD NEW ☐ REDUCE ☐ DELETE ☐

B. ISSUE/DUE OUT ADVICE CODE (   )

INITIAL ISSUE ☐ REPLACEMENT ☐ CANCEL DUE OUT ☐

C. TURN-IN *(Complete all applicable blocks)*

CONDITION		STATUS	YES	NO
SERVICEABLE		COMPLETE *(List missing parts in Block 19)*		
REPARABLE		CALIBRATION REQUIRED		
CONDEMNED		CLEAN, PAINT, ETC		
UNKNOWN		DISASSEMBLY REQUIRED		

DATE AVAILABLE FOR PICKUP

19 JUSTIFICATION AND ITEM DESCRIPTION

20 REVIEWING AUTHORITY COMMENTS

21. ORGN			22. UKC			23. LEVEL			24. DET			25. WRM			26. EMOLOC			27. SUPPLY CONTROL NO.							28. CEMO CONTROL NO.							29. AFLC CONTROL NO.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

AF FORM NOV 81 601

REPLACES AF FORMS 601A, APR 68 AND 601B, APR 70 WHICH WILL BE USED

EQUIPMENT ACTION REQUEST
(See Instructions on Reverse)

Figure 6–8A. Sample AF Form 601.

HOW TO FILL OUT AF FORM 601, EQUIPMENT ACTION REQUEST

BLOCKS WITH ASTERISK (*) TO BE COMPLETED BY BASE SUPPLY OR REVIEWING OFFICE

BLOCK *ENTER*

ROUTING BLOCKS AT TOP

*TO Next office to review form. *CUSTOMER LEAVE BLANK.*
*FROM Office taking current action.
*SIGNATURE Signature of reviewing authority at office taking the current action.
*DATE Date of signature by reviewing authority.
*ACTION TAKEN A check in appropriate block. Check "Approved" when forwarding.
1 A number made up of the 3-digit numbered organization code, 2-digit alpha shop code, and 4-digit numeric julian date, and next unused serial number from the custodian's control register (AF Form 126).
2 Organization's Major Command or Separate Operating Agency, e.g., "TAC".
3 Force Activity Designator (FAD) applicable to this specific equipment support requirement, *if different from organization's normal FAD.* Computer will assign FAD if left blank.
4 Urgency Justification Code (supply will assist). Codes most often applicable to equipment are:

  a Combat Mission Essential, highest priority, justification required.
  b Combat Mission Essential, next highest priority, justification required.
  c Other - items not qualifying for other UJC (routine).

5 Appropriate budget code (supply can assist).
6,7 Self-explanatory. Signature in block 7 not required for turn-in.
8 Last 4 digits of in-use detail document number (use custodian receipt listing, R-14, CA/CRL).
9 National Stock Number, or Part Number.
*10 Use code "A" for mobility, "B" for support, "C" for joint use, "D" for WRM (supply completes).
11 Unit price of item. Supply can assist if price is not known.
12 Unit of issue, for example "EA" for each.
13 Correct Expendability, Recoverability, Repairability, Cost Designator (ERRCD). Base Supply can assist.
*14 Correct Code for exception-type equipment items (supply completes).
15 Nomenclature or brief item name.
16 Allowance Source Code (ASC), which is the table of Allowance (T/A) number or special ASC, if applicable; T/A part, section, subsection and column designations if given. Special rules apply to some items - check with base supply if in doubt.
17 Quantity in use today, current authorization today (both from custodian's receipt listing), new authorization requested (showing the change being requested), and the quantity requested for issue/turn-in. Enter 0 if only an allowance change and no issue, due-out release or turn-in is requested.
18 Checkmarks in blocks indicating action to be taken to (a) change an authorization, (b) issue an item, or (c) turn in an item. Base Supply will enter the advice code for issue/due-out release action. Indicate date item will be ready for pick-up by supply.
19 Complete justification (and item description, if block 18 does not contain full description) for action requested. Use additional sheets of paper if necessary. If the items are to be used for education, teaching or training only, *clearly state this use and be prepared to defend it.* Always enter workload indicators, such as frequency of use. When applicable, give end-item supported (i.e. specific aircraft or other system). Cite maintenance level. Specifically justify UJC codes a or b, if used in block 7. Indicate PCSP-CEM programmer coordination for PCSP-CEM items.

REST OF FORM TO BE COMPLETED BY SUPPLY/REVIEWING ORGANIZATIONS

*20 Self-explanatory. *CUSTOMER LEAVE BLANK.* Use additional paper if necessary. Be specific!
*21 Unit/Organization Number, such as "001" for 1TFW. Do not enter the supply organization code in this block. Must agree with Reporting Organization File (ROF).
*22 Unit Kind Code (UKC) for type of unit. Must agree with ROF.
*23 Numeric organization level indicator. Must agree with ROF.
*24 Detachment number, when applicable. Must agree with ROF.
*25 WRM using command code (must agree with ROF for WRM Items).
*26 Base location code of equipment account.
*27 Base supply control number (base supply entry), first position will be "B".
*28 CEMO control number (CEMO entry), first position will be "C".
*29 AFLC control number (AFLC entry), first position will be "D".

REVIEWING LEVELS RETAIN LAST COPY AFTER ACTION IS TAKEN. MAKE SURE BASE SUPPLY RECEIVES ORIGINAL AND AT LEAST ONE CARBON COPY ON RETURN DISTRIBUTION.

Figure 6–8B. Sample AF Form 601, Instructions.

Preventive Maintenance Procedures. Each piece of equipment or optometric instrument comes packed with a spare parts manual and a repair diagram. If the item of equipment is stocklisted, the repair part must also be stocked in the Federal Supply System. Good housekeeping methods keep your equipment operating longer and help your clinic look cleaner. Dust and grime on the gears and shafts of delicate optomery clinic equipment cause this equipment to jam or act in an erratic manner. Corrosion of the fine threads in focus adjustment eyepieces can cause calibration errors in lensometers, keratometers, and other devices. A fine coating of oily grime can coat the optics of opthalmoscopes, retinoscopes, and phoropter lenses. Poor lubrication of perimeters and other devices can cause noisy and erratic operation.

Proper handling of equipment while you are moving it can reduce the incidence of miscalibration due to excessive vibration or collision with another object. Most optometric equipment calibration adjustment controls are locked in place with tiny screws. Loss of these screws can lead to great calibration errors. Now let's finish this volume with a few tips on keeping optometry clinic equipment and instruments in good shape.

Phoropter unit. Periodically clean the exterior of the phoropter with alcohol. Polish the exterior lenses and prisms with a clean nonabrasive cloth. Clean the retinoscopy lenses with a Q-tip and alcohol. Occasional cleaning of both surfaces of the interior lenses can be done with Q-tips, and alcohol. Don't leave smears on the lenses, and don't let the alcohol drip into the gear mechanism. Keep the lenses covered with they aren't in use.

Chair. Keep exterior clean with a good detergent. Check power cord for cracked or frayed areas. Periodically lubricate moving parts.

Slit lamp. Keep exterior clean with detergent. Clean chin and headrests with alcohol. Keep optics clean with Q-tips and alcohol. Do not disturb the small thumbscrews at the base of the light unit; they control the position and focus of the filament image.

Ophthalmoscope/Retinoscope. Keep the optics clean with alcohol and Q-tips. Make sure the electrical contacts are clean and tight.

AO Non-Contact Tonometer. Dust easy-to-get-to areas with a clean nonabrasive cloth. Clean chin and forehead rests with alcohol sponges. Clean the sensory light and sensory receptors with alcohol and Q-tips. Wipe eyepiece with soft nonabrasive cloth.

Most eye clinic equipment is sturdily built, but a little negligence may lead to disaster. Preventive maintenance and simple repairs done by you may save significant time and money, but don't try to fix something that is beyond your capabilities. Paying for a piece of equipment that you broke may leave you broke.

Exercises (028):

1. Who is supposed to fix broken equipment?

2. Where can you find the replacement part number for a broken piece of stocklisted equipment?

3. What is the best single preventive maintenance measure in the average clinic?

CHANGES FOR THE TEXT: VOLUME 3

Pen-and-Ink Changes:

Page-Col	*Subject*	*Line(s)*	*Correction*
7L	Table 1-2	4 fr bot	Change "4¼"" to "5½"."
		1 fr bot	Change "4½"" to "6"."
7R		16	Change "1½s6" to "11½."
9R		22	Change "M–16" to "M–17."
11L		7	Move "T F 6. The modified zyl frame for the oxygen mask is a 48–22." under "T F 5."

AU GAFS, AL (833838) 200